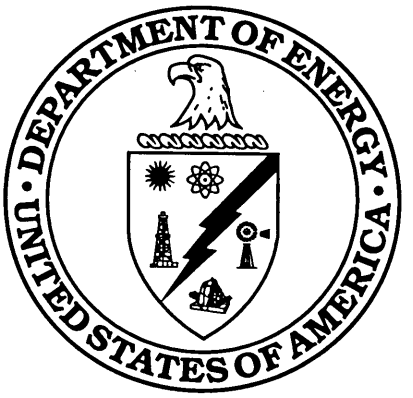
DOE/OR/06-1470&D3

Record of Decision for Waste Area Groups 1 and 7 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky



February 1998

Cleared for Public Release

Department of Energy
Oak Ridge Operations
Paducah Site Office
P.O. Box 1410
Paducah, KY 42001

August 28, 1998

Mr. Robert H. Daniell, Director
Division of Waste Management
Kentucky Department for Environmental Protection
14 Reilly Road, Frankfort Office Park
Frankfort, Kentucky 40601

Mr. Carl R. Froede Jr., P. G.
United States Environmental Protection Agency
Region IV
DOE Remedial Section
Federal Facilities Branch
Waste Management Division
61 Forsyth Street
Atlanta, Georgia 30303

Dear Mr. Daniell and Mr. Froede:

RECORD OF DECISION FOR WASTE AREA GROUPINGS 1 AND 7 AT THE PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH, KENTUCKY, DOE/OR/06-1470&D3

Enclosed for your information is the final Record of Decision (ROD) for Waste Area Groupings (WAGs) 1 and 7 at the Paducah Gaseous Diffusion Plant. The ROD was signed by the Department of Energy (DOE) February 20, 1998, and by the Environmental Protection Agency August 10, 1998. Concurrence with this ROD by the Kentucky Department for Environmental Protection was received in a letter dated June 24, 1998, on the subject matter.

If you have any questions or require additional information, please call Myrna E. Redfield at (502) 441-6815.

Sincerely,

Jimmie C Hodges

Jimmie C. Hodges, Site Manager
Paducah Site Office

Enclosure

cc w/o enclosure:
R. Blumenfeld, CC-10
P. A. Gourieux, Bechtel Jacobs Company/Kevil
J. C. Massey, Bechtel Jacobs Company/Kevil
B. E. Phillips, JEG/Kevil
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T. Taylor, UKFFOU/Frankfort

DOE/OR/06-1470&D3

Record of Decision for Waste Area Groups 1 and 7 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

February 1998

Prepared by
Jacobs EM Team
175 Freedom Boulevard • Kevil, KY 42053
Under Contract DE-AC05-93OR22028

Prepared for
United States Department of Energy
Remediation Management Group

CERTIFICATION

Document Identification: **Record of Decision for Waste Area Groups 1 and 7 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky DOE/OR/06-1470&D3**

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

U. S. Department of Energy
Owner and Operator

Jimmie C. Hodges

2-13-98

Jimmie C. Hodges, Paducah Site Manager
Paducah Site Office
U. S. Department of Energy

Date Signed

The Department of Energy has signed as "owner and operator" and Lockheed Martin Energy Systems, Inc., has signed as "co-operator" this application for the permitted facility. The Department has determined that dual signatures best reflect the actual apportionment of responsibility under which the Department's RCRA responsibilities are for policy, programmatic, funding, and scheduling decisions, as well as general oversight, and the contractor's RCRA responsibilities are for day-to-day operations (in accordance with general directions given by the Department of Energy as part of its general oversight responsibility), including but not limited to, the following responsibilities: waste analyses and handling, monitoring, record keeping, reporting, and contingency planning. For purposes of the certification required by 40 CFR Section 270.11(d), the Department of Energy's representatives certify, to the best of their knowledge and belief, the truth accuracy and completeness of the application for their respective areas of responsibility.

CERTIFICATION

Document Identification: **Record of Decision for Waste Area Groups 1 and 7 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky DOE/OR/06-1470&D3**

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Lockheed Martin Energy Systems, Inc.
Co-Operator

2/13/98

Jimmy C. Massey, Site Manager
Environmental Management and Enrichment Facilities
Lockheed Martin Energy Systems, Inc.

Date Signed

The Department of Energy has signed as "owner and operator" and Lockheed Martin Energy Systems, Inc., has signed as "co-operator" this application for the permitted facility. The Department has determined that dual signatures best reflect the actual apportionment of responsibility under which the Department's RCRA responsibilities are for policy, programmatic, funding, and scheduling decisions, as well as general oversight, and the contractor's RCRA responsibilities are for day-to-day operations (in accordance with general directions given by the Department of Energy as part of its general oversight responsibility), including but not limited to, the following responsibilities: waste analyses and handling, monitoring, record keeping, reporting, and contingency planning. For purposes of the certification required by 40 CFR Section 270.11(d), Lockheed Martin Energy Systems, Inc.'s, representatives certify, to the best of their knowledge and belief, the truth accuracy and completeness of the application for their respective areas of responsibility.

PREFACE

This *Record of Decision for Waste Area Groups 1 and 7 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* DOE/OR/06-1470&D3, was prepared in accordance with requirements under the Comprehensive Environmental Response, Compensation, and Liability Act; the Resource Conservation and Recovery Act; and Kentucky hazardous waste statutes (K.R.S. 224.46-520 and K.R.S. 224.46-530). This document was prepared under Work Breakdown Structure 7.1.04.06.02 (Activity Data Sheet 5304). This document follows the outline for records of decision contained in the draft Federal Facility Agreement being negotiated for the Paducah Gaseous Diffusion Plant (PGDP) among the United States Department of Energy (DOE), the United States Environmental Protection Agency (EPA), and the Kentucky Department for Environmental Protection (KDEP). Publication of this document meets a primary document deliverable milestone for the PGDP's Environmental Management Program. This document provides the record of information and rationale that the EPA, the KDEP, and the DOE utilized in the selection of preferred remedial actions/corrective measures at the Waste Area Groups 1 and 7 solid waste management units. Information provided in this document forms the basis for the development of the remedies selected for this project.

CONTENTS

TABLES

FIGURES

ACRONYMS AND ABBREVIATIONS

The following list of acronyms and abbreviations is provided to assist in the review of this document.

^{237}Np	neptunium-237
^{238}Pu	plutonium-238
^{99}Tc	technetium-99
^{228}Th	thorium-228
^{230}Th	thorium-230
^{232}Th	thorium-232
^{234}U	uranium-234
^{235}U	uranium-235
^{238}U	uranium-238
ALARA	as low as reasonably achievable
amsl	above mean sea level
AR	administrative record
ARAR	applicable or relevant and appropriate requirement
bls	below land surface
C.F.R.	Code of Federal Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	centimeter(s)
COC	chemical of concern
COE	United States Army Corps of Engineers
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
CSOU	Comprehensive Site Operable Unit
CWA	Clean Water Act
DCA	dichloroethane
DCE	dichloroethene
DOD	United States Department of Defense
DOE	United States Department of Energy
ELCR	excess lifetime cancer risk
EPA	United States Environmental Protection Agency
Fed. Reg.	*Federal Register*
FFA	Federal Facility Agreement
FFCA	Federal Facility Compliance Act
FS	feasibility study
ft	foot/feet
FTA	fire training area
g	gram(s)
gal	gallon(s)
gpm	gallons per minute
GPPP	Groundwater Protection Program Plan
HDPE	high-density polyethylene
HI	hazard index
HSWA	Hazardous and Solid Waste Amendments
J	qualifier indicating estimated value
K.A.R.	Kentucky Administrative Regulations
K.R.S.	Kentucky Revised Statutes
KDEP	Kentucky Department for Environmental Protection
KDOW	Kentucky Department for Environmental Protection, Division of Water

kg	kilogram(s)
km	kilometer(s)
KOW	Kentucky Ordnance Works
KPDES	Kentucky Pollutant Discharge Elimination System
l	liter
LDR	land disposal restriction
LMES	Lockheed Martin Energy Systems, Inc.
m	meter(s)
mg	milligram(s)
mgd	million gallons per day
mil	thousandths of an inch
mrem	millirem
MW	monitoring well
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOV	Notice of Violation
NWP	nationwide permit
O&M	operation and maintenance
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
pCi	picocurie(s)
PGDP	Paducah Gaseous Diffusion Plant
pH	logarithm of the reciprocal of the hydrogen-ion concentration
PPE	personal protective equipment
PRAP	proposed remedial action plan
PRP	potentially responsible party
RCRA	Resource Conservation and Recovery Act
RFI	Resource Conservation and Recovery Act facility investigation
RGA	Regional Gravel Aquifer
RI	remedial investigation
ROD	record of decision
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
sec	second
SSAB	Site Specific Advisory Board
SWMU	solid waste management unit
T&E	threatened and endangered
TBC	to be considered
TCA	trichloroethane
TCE	trichloroethene
TNT	trinitrotoluene
Tu_a	acute toxicity
U.S.C.A.	United States Code Annotated
UCRS	Upper Continental Recharge System
USEC	United States Enrichment Corporation
UST	underground storage tank
VOC	volatile organic compound
WAG	waste area group
WTP	water treatment plant
yd	yard(s)
yr	year(s)
µg	microgram(s)
µmhos	micromhos: the reciprocal of resistivity

PART 1

DECLARATION

DECLARATION FOR THE RECORD OF DECISION FOR WASTE AREA GROUPS 1 AND 7

SITE NAME AND LOCATION

Waste Area Groups 1 and 7
Paducah Gaseous Diffusion Plant
United States Department of Energy
Paducah, Kentucky

STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) presents the final remedial action decisions selected for soils and sediments in each of the solid waste management units (SWMUs) of Waste Area Groups (WAGs) 1 and 7 at the Paducah Gaseous Diffusion Plant (PGDP) near Paducah, Kentucky. Waste Area Group 1 consists of SWMUs 100 and 136. Waste Area Group 7 consists of SWMUs 8 and 130 through 134. All SWMUs are located on United States Department of Energy (DOE) property. Waste Area Group 1 is located within the boundaries of the plant security fence. Solid Waste Management Units 130 through 134 also are located within the plant security fence. Solid Waste Management Unit 8 is located to the southwest of the PGDP facility, beyond the boundaries of the plant security fence.

By mutual consent among the United States Environmental Protection Agency (EPA), the Kentucky Department for Environmental Protection (KDEP), the United States Department of Defense (DOD), the United States Army Corps of Engineers (COE), and the DOE, it was agreed that the evaluation and implementation of any remedial actions required for the Kentucky Ordnance Works (KOW) SWMUs [SWMU 94 (KOW Sewage Treatment Plant), SWMU 95 (KOW Burn Area), and SWMU 157 (KOW Toluene Spill Site)], formerly included in WAGs 1 and 7, would be the responsibility of the DOD and conducted on behalf of the DOD by the COE. Correspondence outlining the agreed upon responsibilities of the DOE, the COE, and the DOD was submitted to the EPA and the KDEP April 5, 1996. Due to the agreements reached among these entities, remedial technologies for the KOW SWMUs are not discussed further in this ROD and will be evaluated as part of the WAG 10 investigation by the COE. Additionally, by written mutual consent, the EPA, the KDEP, and the DOE agreed that an evaluation of remedial alternatives for SWMU 38, the C-615 Sewage Treatment Plant, would be deferred until the unit ceases operation. Consequently, no remedial actions are discussed for these SWMUs in this ROD.

The remedies selected for each of the WAGs 1 and 7 SWMUs are intended to address the contaminants of concern presently identified and will serve as a step toward comprehensively addressing contamination found across the PGDP site. These actions are not intended to address remediation of any existing or future surface- or ground-water contamination at this site.

The DOE will evaluate the necessity for surface- and/or ground-water remedial actions for the SWMUs in WAGs 1 and 7 separately from this action during site-wide, comprehensive evaluations of surface- and ground-water contamination at this site. As part of the comprehensive evaluations, the DOE, the EPA, and the KDEP will determine whether implementing surface- and ground-water remedial actions at SWMU 8 is necessary to protect human health and the environment. Through the comprehensive evaluations for surface water (WAGs 18 and 25) and ground water (WAG 26), known

also as the Comprehensive Site Operable Units (CSOUs), the remedial action alternatives for the surface water and ground water at the PGDP, including at WAGs 1 and 7, will be selected. Through the CSOU process, all data on the surface and ground water at WAGs 1 and 7 and at the other PGDP SWMUs will be evaluated. Finally, all risks to human health and the environment from the surface and ground water at the PGDP, and all legally applicable or relevant and appropriate requirements, also will be evaluated.

This ROD was prepared based on the administrative record (AR) for these WAGs. The AR includes documentation of the rationale for undertaking the remedial actions at WAGs 1 and 7. Major documents included in the AR are as follows: the *Feasibility Study for Waste Area Groups 1 and 7 and Kentucky Ordnance Works Solid Waste Management Units 94, 95, and 157 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* DOE/OR/06-1416&D2; the *Proposed Remedial Action Plan for Waste Area Groups 1 and 7 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* DOE/OR/06-1428&D4; and the *Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation Report for Waste Area Groupings 1 and 7 at Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* DOE/OR/07-1404&D2.

The remedial actions identified in this ROD were selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act, the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments (HSWA), and K.R.S. Chapter 224, subchapter 46. The ROD was prepared in accordance with a hazardous waste management permit issued by the KDEP pursuant to K.R.S. Chapter 224, subchapter 46, and a permit for corrective action issued by the EPA pursuant to the HSWA. Both permits bear the same permit number, KY8-890-008-982, and, throughout this document, are collectively referred to as the RCRA permits. Once the ROD is signed, the permit will be modified to reflect the selected remedies of these SWMUs.

The ROD also was prepared in accordance with a draft Federal Facility Agreement (FFA) that currently is being negotiated among the DOE, the EPA, and the KDEP. A draft of the FFA agreed to by all three entities was made available for public review and comment April 19, 1997. The FFA, when issued, will coordinate the requirements of the CERCLA and the RCRA permits.

The remedial actions will be implemented pursuant to the PGDP's RCRA permits, this ROD, and the draft FFA. The Commonwealth of Kentucky concurs with the DOE on, and the EPA approves, the selected remedial actions. The selected remedial actions will address the contaminants of concern in the soils and sediments of WAGs 1 and 7 and will serve as a step toward comprehensively addressing contamination found across the PGDP site.

ASSESSMENT OF THE SITE

Actual or threatened releases from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

Risks for industrial workers slightly exceed EPA thresholds at SWMUs 8 and 100 [please refer to the Feasibility Study (FS) in the WAGs 1 and 7 AR for more detail regarding risk thresholds]; however, these risks are due to direct contact with surface water and sediments contaminated with metals. As discussed in the FS for WAGs 1

and 7, DOE/OR/06-1416&D2, the direct contact exposure pathway is associated with numerous uncertainties (such as conservative assumptions associated with absorption of metals) and, therefore, is not used as the sole pathway in making remedial decisions (refer to the FS for a more detailed discussion of the uncertainties associated with the risk assessment). Additional evaluation of potential risks at SWMU 100 indicate there are no unacceptable risks to current industrial workers based upon exposure assumptions adjusted to reflect the actual time workers spend at the unit (primarily to perform upkeep activities). Additionally, it is reasonable to assume that these exposure assumptions will remain the same in the future. Consequently, no further action, outside of maintaining institutional controls, is warranted at SWMU 100. Currently, contaminated surface water will be addressed on a site-wide basis during the surface-water CSOU investigation (WAGs 18 and 25).

While contaminant conditions at SWMUs 8 and 100 are similar, there also is a risk that a human or animal could come into direct contact with acidic leachate being released from SWMU 8 into sediments above the water level in the creeks. These risks, when combined with the Notice of Violation issued by the Kentucky Department for Environmental Protection, Division of Water (KDOW), indicate that limited action is necessary at SWMU 8 to protect human health and animals.

At SWMUs 130 through 134 and the soils of SWMU 136, risks and hazard indices for human health and animals do not exceed threshold values; therefore, these units require no further action. Any contaminated ground water associated with SWMU 136 will be evaluated as part of the ground water CSOU (WAG 26).

DESCRIPTION OF SELECTED REMEDY

The primary purpose of the remedies described within this document are to reduce the risks that could pose a threat to human health and the environment associated with direct contact to acidic leachate at SWMU 8. The evaluation of human health and ecological risks posed by these units was conducted as part of the remedial investigation performed at this site.

The remedial action at SWMU 8 consists of a deed notice and restrictions and the installation of riprap and signs. The current surface-water monitoring program will continue as directed by the KDOW. Additional ground-water monitoring wells will be installed, as needed.

Since SWMUs 130 through 134 and 136 do not present an unacceptable risk to human health and the environment, no further remedial action will be performed at these units. Additionally, since there are no risks to industrial workers at SWMU 100 based upon actual exposures at the unit, no further action (outside of maintaining institutional controls) is warranted. However, since contamination will remain at SWMUs 8 and 100, and in order to evaluate the reliability of controls in providing protection, five-year reviews will be conducted for these SWMUs under the CERCLA.

All work on the WAGs 1 and 7 project has been conducted by mutual agreement among the DOE, the EPA, and the KDEP. Further, the EPA and the KDEP have participated in the development of this ROD, including review and comment on the document's content.

STATUTORY DETERMINATION

The remedial actions described herein are protective of human health and the environment, comply with federal and state requirements that are legally applicable or

relevant and appropriate to the WAGs 1 and 7 SWMUs, and are cost effective. The selected remedies for the WAGs 1 and 7 SWMUs do not satisfy the CERCLA § 121(b) [42 U.S.C.A. § 9621(b)] statutory preference for having, as a principal element, treatment that results in a permanent and significant reduction of toxicity, mobility, or volume because risk analysis indicates that such remedies are not necessary. The selected remedies do, however, satisfy the CERCLA § 121(b) statutory preference for using permanent solutions and alternative treatment technologies to the extent practicable. The limited actions selected for SWMUs 8 and 100, and the No Further Action decisions selected for SWMUs 130 through 134 and 136, are viewed as permanent and final decisions.

Since contamination will remain at SWMUs 8 and 100 above levels that allow for unlimited use and unrestricted exposure under the industrial land-use scenario, five-year reviews will be conducted pursuant to CERCLA § 121(c) [42 U.S.C.A. § 9621(c)] and 40 C.F.R. § 300.430(f)(4)(ii)]. Five-year CERCLA reviews will not be conducted at SWMUs 130 through 134 and 136 because the selected remedial actions allow for unlimited use and unrestricted exposure.

Date: 2/20/98

Rodney R. Nelson
Assistant Manager for Environmental Management
United States Department of Energy

Date: 8/10/98

Richard D. Green
~~Acting~~ Director, Waste Management Division
United States Environmental Protection Agency, Region 4

PART 2

DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND DESCRIPTION

The Paducah Gaseous Diffusion Plant (PGDP) is located in western Kentucky, approximately 16.1 km (10 miles) west of Paducah and about 6.44 km (4 miles) south of the Ohio River (Figure 2-1). It is an uranium enrichment facility that supplies nuclear fuel for commercial reactors. The plant, owned by the United States Department of Energy (DOE), began operations in 1952 and became fully operational in 1955.

The Energy Policy Act of 1992 transferred operation of the DOE's uranium enrichment facilities to the United States Enrichment Corporation (USEC). Effective July 1, 1993, Martin Marietta Utility Services, Inc., (now Lockheed Martin Utility Services, Inc.) contracted with the USEC to provide operation and maintenance (O&M) services. The DOE contracted with Martin Marietta Energy Systems, Inc., [now Lockheed Martin Energy Systems, Inc., (LMES)] to provide environmental restoration and waste management services for the PGDP under the DOE's Environmental Management Program.

This Record of Decision (ROD) addresses eight solid waste management units (SWMUs) in Waste Area Groups (WAGs) 1 and 7 at the PGDP. This ROD does not address three Kentucky Ordnance Works (KOW) SWMUs formerly used by the United States Department of Defense (DOD), which were grouped with WAGs 1 and 7 for environmental investigation purposes. However, the current draft of the PGDP Site Management Plan, DOE/OR/07-1207&D3, places the three SWMUs [SWMU 94 (Sewage Treatment Plant), SWMU 95 (Burn Area), and SWMU 157 (Toluene Spill Site)] into WAG 10. The United States Army Corps of Engineers (COE), on behalf of the DOD, has committed verbally to remediate these three sites, and the United States Environmental Protection Agency (EPA) and the Kentucky Department for Environmental Protection (KDEP) have agreed to allow the COE to proceed with the cleanup. However, in a letter to the DOE dated May 23, 1996, (Appendix B), the KDEP also indicated that the DOE ultimately would be responsible for the cleanup of the KOW SWMUs should the COE fail to meet Kentucky cleanup standards.

In addition to the three KOW SWMUs, this ROD does not address SWMU 38 (the C-615 Sewage Treatment Plant), formerly included in WAG 1. The KDEP, the EPA, and the DOE have agreed to defer evaluation of remedial alternatives for SWMU 38 until the unit ceases operation. For this reason, SWMU 38 will be evaluated at a later date as part of WAG 29.

Finally, this ROD does not address remediation of surface or ground water at each of the SWMUs. Any risks to human health or the environment present at the site due to contaminated surface or ground water will be addressed as part of the two Comprehensive Site Operable Unit (CSOU) evaluations conducted for WAGs 18 and 25 (i.e., surface water) and WAG 26 (i.e., ground water).

The locations of the SWMUs in WAGs 1 and 7 are shown in Figure 2-2. The eight SWMUs addressed in this ROD are as follows:

- **WAG 1**
  - — SWMU 100, the Fire Training Area (FTA); and
  - — SWMU 136, the C-740 Trichloroethene (TCE) Spill Site.

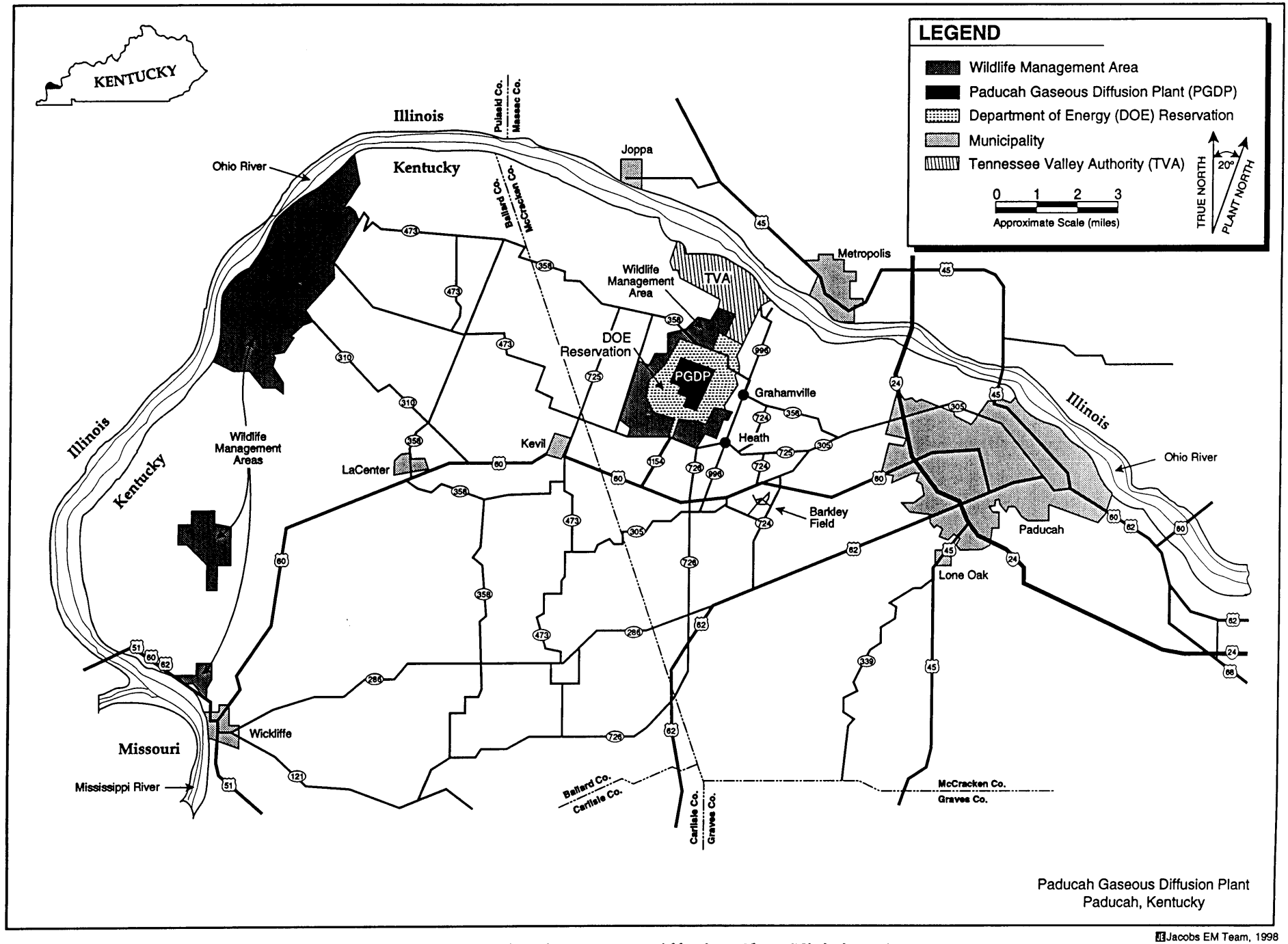


Figure 2-1. Paducah Gaseous Diffusion Plant Vicinity Map

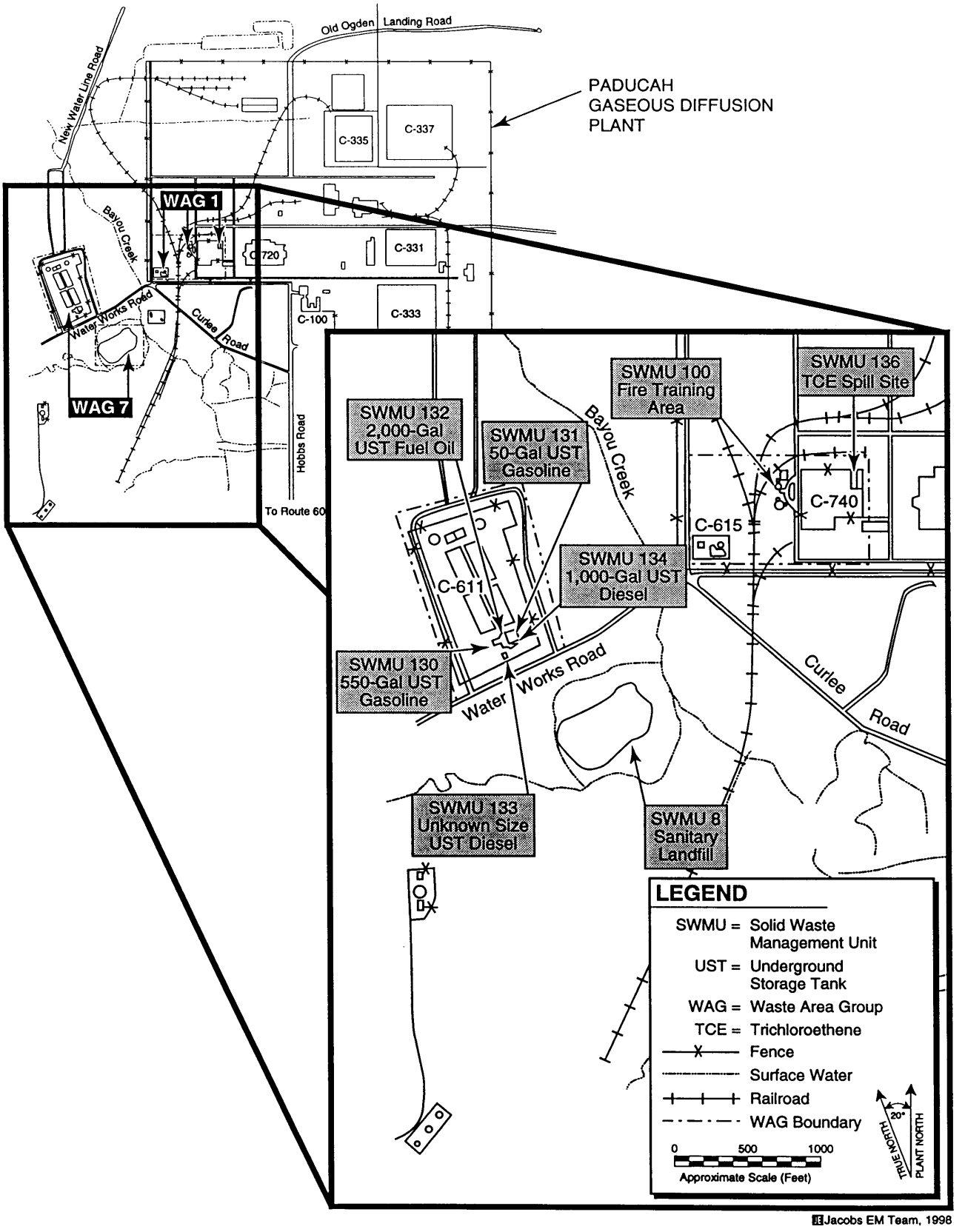


Figure 2-2. Locations of Solid Waste Management Units in Waste Area Groups 1 and 7

- WAG 7

  — SWMU 130, a 2,082-liter (550-gal) gasoline underground storage tank (UST) located adjacent to the C-611 Water Treatment Plant (WTP);

  — SWMU 131, a 189-liter (50-gal) UST reportedly located adjacent to the C-611 WTP;

  — SWMU 132, a 7,571-liter (2,000-gal) fuel oil UST located adjacent to the C-611 WTP;

  — SWMU 133, a diesel fuel UST of unknown capacity located adjacent to the C-611 WTP;

  — SWMU 134, a 3,785-liter (1,000-gal) diesel fuel UST located adjacent to the C-611 WTP; and

  — SWMU 8, the C-746-K Sanitary Landfill.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

Following are descriptions of events and legal actions pertaining to the SWMUs addressed in this ROD. Also, brief descriptions of the units themselves are provided.

2.2.1 Waste Area Group 1

Waste Area Group 1 is located within the plant security fence in the southwestern corner of the PGDP (Figure 2-2). It includes two units that will be addressed by this document: SWMU 100 (the FTA) and SWMU 136 (the C-740 TCE Spill Site).

2.2.1.1 Solid Waste Management Unit 100: the Fire Training Area

The FTA is located in the southwest corner of the PGDP, immediately west of Fourth Street (Figure 2-3). It consists of one large rectangular surface burn area, two circular burn pan areas, one circular electric pump area, an elevated and bermed fuel tank area, and two square burn area depressions. The burn areas are unlined and are not bermed. The FTA has been used since 1982 for staging fire training exercises involving waste oils, fuels, and other combustible liquids. Combustible liquids were not burned in the unlined areas after 1987. Fire training exercises continue to be conducted in the vicinity, but, in order to prevent any negative impacts to the environment, no burning is conducted in unlined areas and combustible liquids are no longer used.

2.2.1.2 Solid Waste Management Unit 136: the C-740 Trichloroethene Spill Site

The TCE Spill Site is a small rectangular area, approximately 5 m x 2 m (15 ft x 6 ft), located in the southwest corner of the PGDP within the plant security fence (Figure 2-2). It is situated at the northwest corner of a concrete pad at the northeastern edge of the C-740 Material Yard (Figure 2-3). The C-740 Material Yard is an active storage yard that has been used since the early 1970s for storing various scrap metals and drums. A 208-liter (55-gal) drum stored on the concrete pad leaked TCE onto the pad and into the gravel and soil adjacent to the western edge of the pad in May 1990. In October 1990, soils contaminated with TCE were excavated from a 5 m x 2 m (15 ft x 6 ft) area, to a depth of 1 m (3 ft). Soil samples collected from the base of the excavation pit were found to have TCE concentrations as high as 21,000 µg/kg, indicating that TCE-contaminated

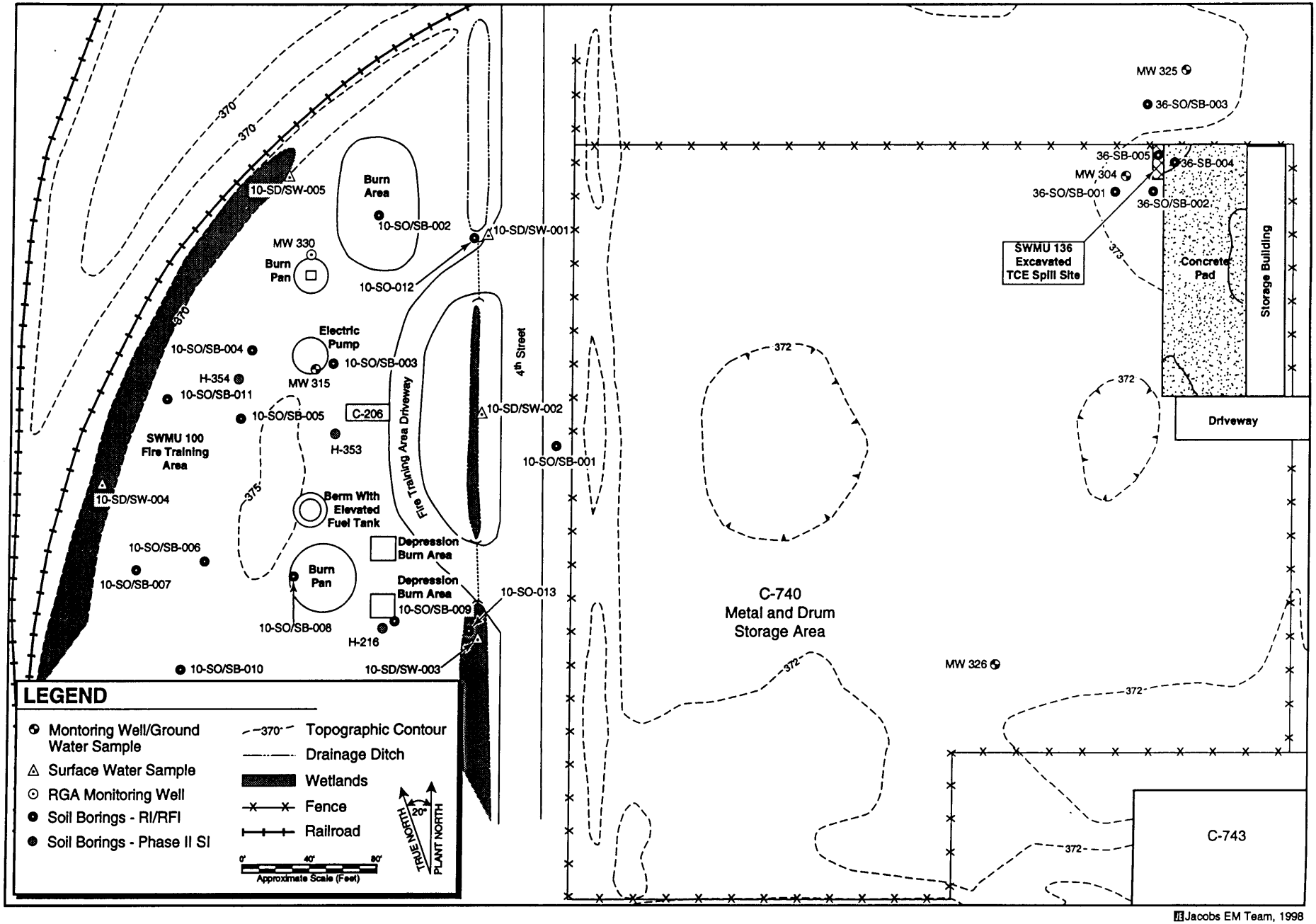


Figure 2-3. Solid Waste Management Units 100 and 136 Sample Location Map

soils had not been completely removed. However, as further discussed in Section 2.5.3.2, subsequent sampling conducted in 1994 as part of the Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) indicates that no measurable residual TCE soil contamination remains at SWMU 136.

2.2.2 Waste Area Group 7

Waste Area Group 7 consists of SWMUs 130 through 134 (the five C-611 USTs) and SWMU 8 (the C-746-K Sanitary Landfill). It is located outside the plant security fence near the southwest corner of the PGDP (Figure 2-2). All of the SWMUs in WAG 7 are inactive units.

2.2.2.1 Solid Waste Management Units 130 through 134: the C-611 Underground Storage Tanks

The C-611 USTs (SWMUs 130 through 134) are located southwest of the PGDP security-fenced area in the vicinity of the C-611 WTP, west of Bayou Creek (Figure 2-4). The C-611 WTP was built about 1942 as part of the KOW and later was expanded to support operations at the PGDP. All five USTs located in the vicinity of the WTP currently are inactive. With the exception of SWMU 133, which is of unknown size, the C-611 USTs range in capacity from 189 to 7,571 liters (50 to 2,000 gal). Two of the USTs (SWMUs 130 and 131) were reportedly used for gasoline storage from 1942 to 1945 in support of KOW operations. However, efforts to locate the SWMU 131 UST during the Resource Conservation and Recovery Act facility investigation/remedial investigation (RFI/RI) were unsuccessful, so it is possible that it never existed. Solid Waste Management Unit 132 was used for fuel oil storage from approximately 1942 to 1955, initially as part of the KOW, and later in support of PGDP activities. It was abandoned in place by filling the tank with sand. The dates of operation of the remaining two USTs (SWMUs 133 and 134) are unknown; both were reportedly used for diesel storage and are known to have been removed from service by 1975. The SWMU 133 tank was abandoned in place filling the tank with grout.

2.2.2.2 Solid Waste Management Unit 8: the C-746-K Sanitary Landfill

The C-746-K Sanitary Landfill (SWMU 8) is located southwest of the PGDP fenced security area, approximately 200 m (656 ft) southeast of the C-611 WTP (Figure 2-5). The landfill is roughly rectangular in shape and measures approximately 152 m x 213 m (500 ft x 700 ft). It is situated immediately west of Bayou Creek and north of an unnamed tributary of Bayou Creek. The ground surface is vegetated and slopes in a radial fashion from a maximum elevation of 119 m (392 ft) amsl near the center of the western half of the landfill to a low of approximately 110 m (360 ft) amsl near Bayou Creek at the eastern edge of the landfill. Drainage ditches located along the western and northern edges of the landfill flow to the south into the unnamed tributary and to the east into Bayou Creek, respectively.

Records indicate that the PGDP used the landfill between 1951 and 1981 for disposal of fly ash from the plant's coal combustion boilers, uncontaminated combustible plant waste, and potentially radiologically contaminated plant waste. According to the *Hydrologic Investigation — Existing Sanitary Landfill Closure, Union Carbide Corporation, Gaseous Diffusion Plant, Paducah, Kentucky,* conducted by Wehran Engineering in 1981, the fly ash was disposed in trenches excavated 2 to 3 m (5 to 10 ft) bls. During operations, trenches were cut in the fly ash and used for burning trash. This practice ceased in 1967, after which waste was buried without burning. The waste, containing

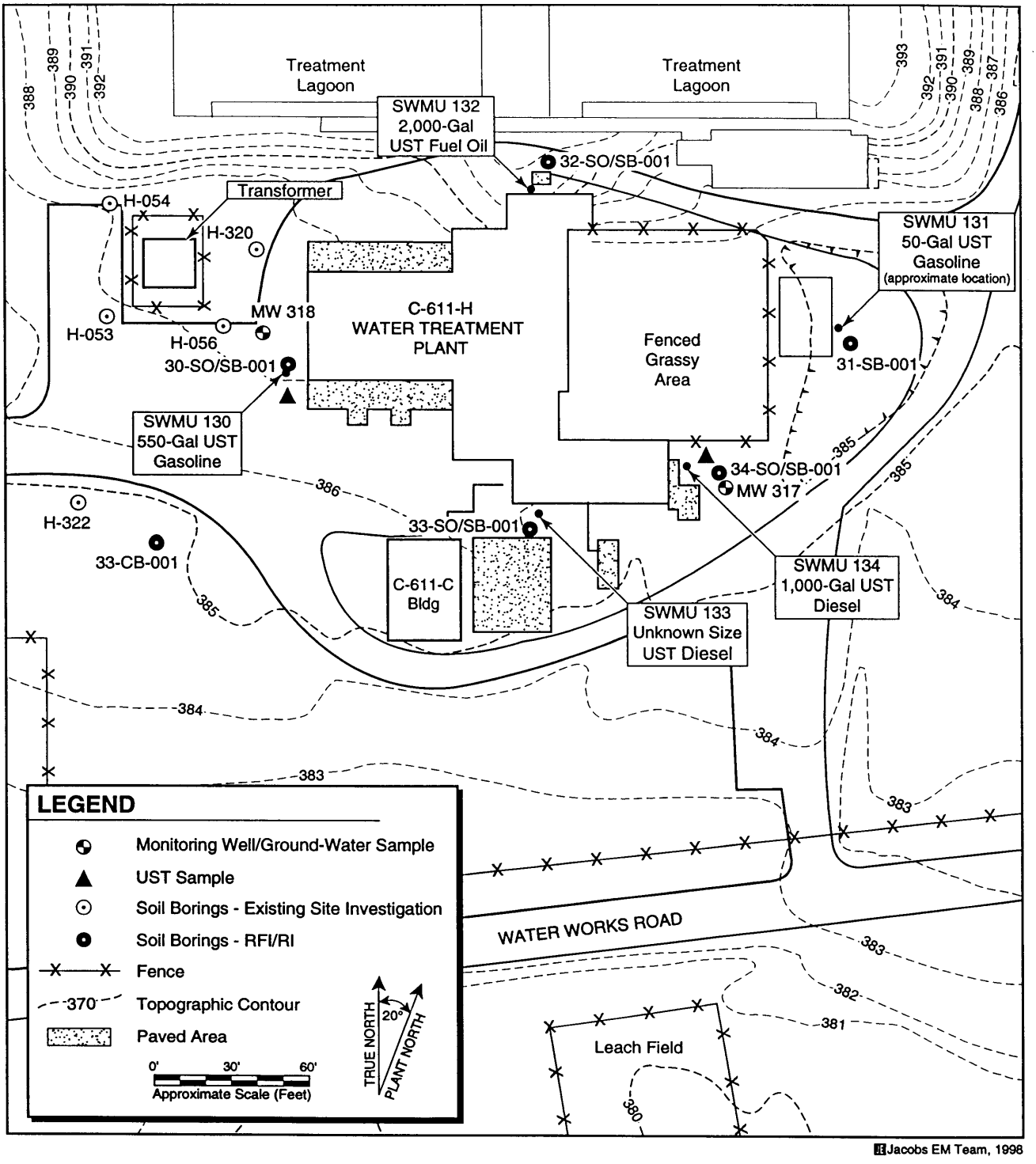
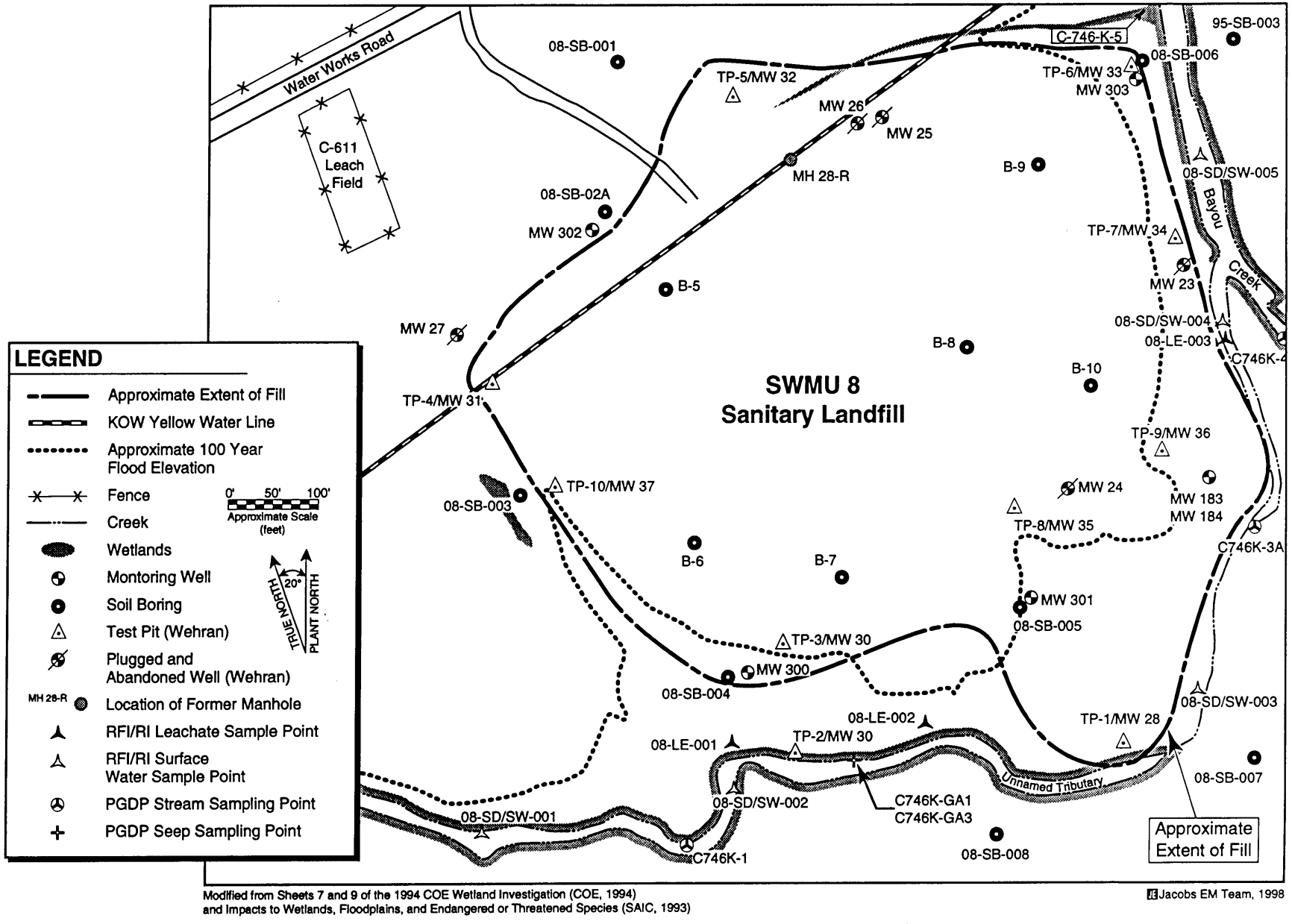


Figure 2-4. Solid Waste Management Units 130 through 134 Sample Location Map



Modified from Sheets 7 and 9 of the 1994 COE Wetland Investigation (COE, 1994)
and Impacts to Wetlands, Floodplains, and Endangered or Threatened Species (SAIC, 1993)

Jacobs EM Team, 1998

Figure 2-5. Solid Waste Management Unit 8 Sample Location Map

primarily office waste with some construction debris and kitchen waste, was placed in trenches excavated within the fly ash and covered, when necessary, with additional fly ash or soil fill. In addition to these materials, sludge from the C-615 Sewage Treatment Plant may have been buried at the unit, as it was reportedly used as fill material. Soil boring information indicates that up to 9 m (28 ft) of fly ash and trash were placed in the landfill. The landfill was closed in 1982 and covered with a 15- to 30-cm (6- to 12-inch) clay cap and a 46-cm (18-inch) vegetative cover.

On January 30, 1992, the PGDP personnel discovered leachate in a ditch on the southwest side of the landfill. Sampling immediately was conducted at five leachate seep locations around the landfill. Volatile organic compounds (VOCs) [TCE; 1,1-dichloroethene (DCE); 1,1-dichloroethane (DCA); and trans-1,2-DCE] and metals (aluminum, iron, manganese, and zinc) were detected above background levels in the leachate samples. Low levels of radionuclides [technetium-99 (^{99}Tc) and uranium] also were detected in some leachate samples. The leachate was acidic (the pH ranged from 2.3 to 5.5), and the particulate matter in the leachate was generally orange to yellow in color. The precipitation of dissolved metals (primarily iron and aluminum) from the leachate was thought to be causing the orange to yellow staining observed at various points along the creek banks. This condition was deemed in noncompliance with the water quality provisions of 401 K.A.R. 5:031. The provisions of 401 K.A.R. 5:031 that posed an issue at the landfill were those that prohibit discharges that produce "objectionable color" in waters of the Commonwealth of Kentucky. On September 15, 1992, the KDEP issued a Notice of Violation (NOV) to the PGDP for "unpermitted seepage areas from C-746-K Sanitary Landfill into waters of the Commonwealth."

As a result of the NOV, and with the approval of the KDEP and the EPA, the DOE immediately undertook an interim corrective action to address the seeps. To prevent any further release of solids to the unnamed tributary, a sandbag dam with a liner was installed in the drainage ditch southwest of the landfill. The interim action also repaired the subsidence of the existing landfill cap by recontouring the cap to promote surface-water runoff. Since the landfill cap repair was completed in October 1992, the landfill and the adjacent creeks have been inspected regularly to determine if the interim measures have been effective in reducing seepage into the creeks. In addition, a surface-water monitoring program was initiated at the landfill to monitor contaminant levels in the leachate and adjacent creeks. Through the monitoring program, samples are collected quarterly at suspected seep source sites on the banks of Bayou Creek and the unnamed tributary and locations upstream and downstream of the landfill (Figure 2-5).

2.3 HIGHLIGHTS OF COMMUNITY PARTICIPATION

The DOE issued the *Proposed Remedial Action Plan for Waste Area Groups 1 and 7 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/06-1428&D2, June 25, 1996, and held a public comment period from June 25, 1996, until August 9, 1996. A public meeting was held July 23, 1996, at the LMES facility in Kevil, Kentucky, to brief the public on the remedial alternatives under consideration at that time. At the meeting, DOE personnel also answered questions from the public on a proposed wetland alternative at the landfill and solicited both written and verbal comments. The DOE received oral comments during the public meeting and written comments during the 45-day public comment period. These comments, and formal DOE responses to these comments, are provided in the Responsiveness Summary, which is presented in Part 3 of this ROD.

In response to comments from the public, the EPA, and the Commonwealth of Kentucky, changes were made to the Proposed Remedial Action Plan (PRAP). The revised PRAP

Proposed Remedial Action Plan for Waste Area Groups 1 and 7 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/06-1428&D4, was issued to the public after a Notice of Availability announcing the 45-day public review period was published in *The Paducah Sun*, December 22, 1996. During the public comment period (December 23, 1996, through February 5, 1997), the PRAP was made available for public review at the Paducah Public Library and the off-site DOE Environmental Information Center located in the West Kentucky Technology Park in Kevil, Kentucky. Specific groups that received individual copies of the PRAP included the local PGDP Neighborhood Council, Natural Resource Trustees, the Site Specific Advisory Board (SSAB), and the PGDP Environmental Advisory Committee. The PRAP is part of the Administrative Record (AR) File, as required by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) [40 C.F.R. § 300.825(a)(2)].

A public meeting was held January 16, 1997, to discuss the changes in the PRAP. No objections were expressed at this meeting. Upon request from the public, the comment period was extended 30 days. A response to the comments received during the public participation period for this version of the PRAP is presented in the Responsiveness Summary, which is presented in Part 3 of this ROD.

2.4 SCOPE AND ROLE OF THE OPERABLE UNITS

The PGDP presents unusually complex problems in terms of hazardous waste management and environmental releases. The DOE's proposed strategy is to divide the site into operable units (OUs) grouped by source areas, and CSOUs, one each for ground water and surface water. Discrete response actions will be selected and implemented for each source area OU, as well as the CSOUs, which are impacted by commingled releases from the source area OUs. Prioritization for investigation and possible remedial action has been assigned to each of the CSOUs (ground-water and surface-water OUs) and source area OUs depending on their potential for contributing to off-site contamination. As a suspected source of off-site contamination, SWMU 8 was a high priority for remediation.

2.5 SUMMARY OF SITE CHARACTERISTICS

Following are hydrological and geological descriptions of the PGDP and individual SWMUs.

2.5.1 Hydrogeologic Characteristics of the Paducah Gaseous Diffusion Plant Area

The sources for the following information are the *Report of the Paducah Gaseous Diffusion Plant Groundwater Investigation Phase III*, KY/E-150, and the *Draft Northeast Plume Preliminary Characterization Summary Report*, DOE/OR/07-1339&D2.

2.5.1.1 Regional surface-water hydrology

The PGDP is located in the western portion of the Ohio River Basin (Figure 2-6). A local drainage divide causes the plant's surface water to flow to the east and northeast toward Little Bayou Creek or to the west and northwest toward Bayou Creek. Both Bayou and Little Bayou creeks are perennial streams that discharge into the Ohio River. The SWMUs within WAGs 1 and 7 are located within the Bayou Creek watershed.

Bayou Creek flows northward along the western boundary of the plant, from approximately 4 km (2.5 miles) south of the plant to the Ohio River. Little Bayou Creek originates within DOE property and flows northward along the eastern boundary of the

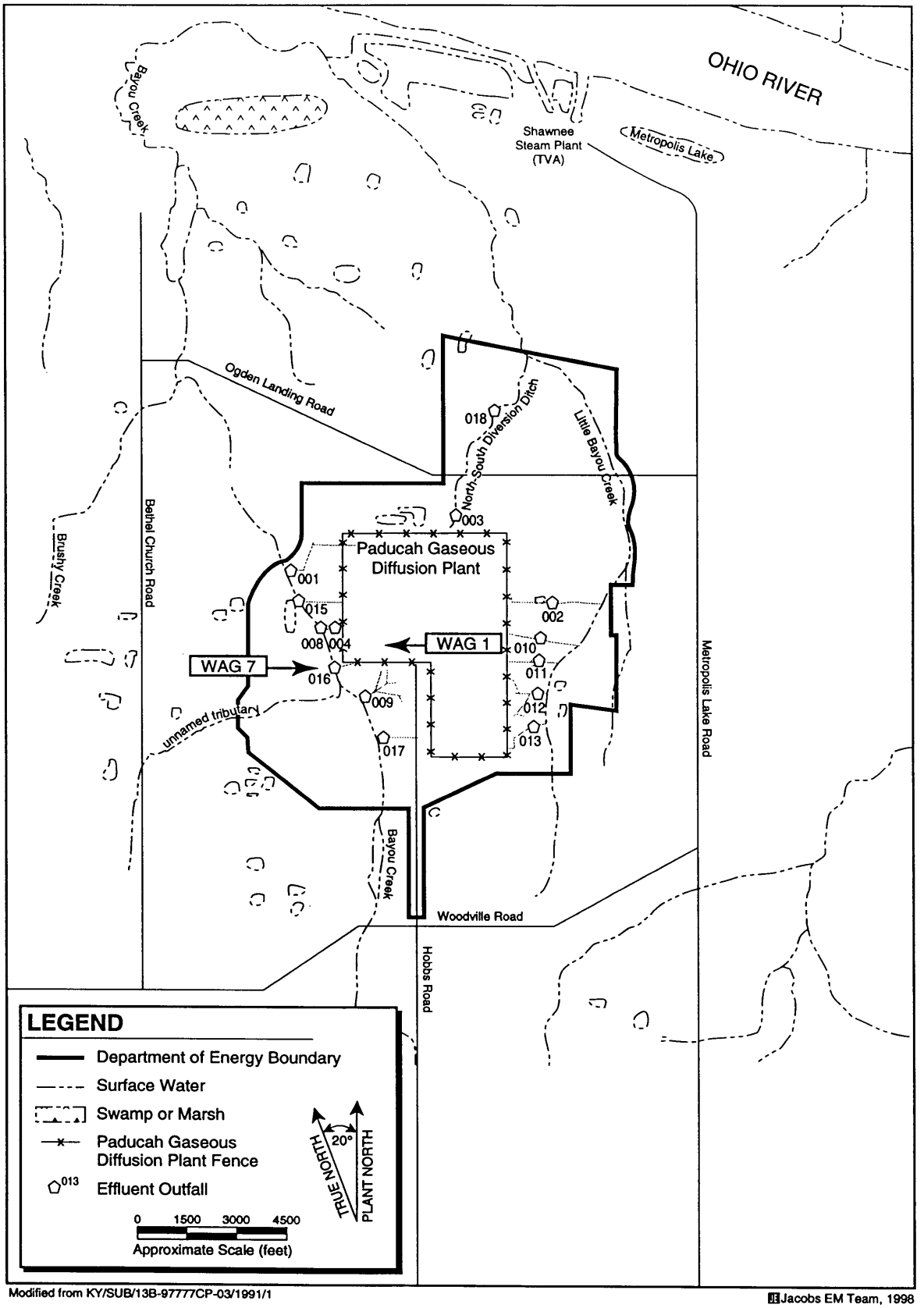


Figure 2-6. Surface-Water Features in the Vicinity of the Paducah Gaseous Diffusion Plant

plant. Little Bayou Creek joins Bayou Creek in a marsh located approximately 4.8 km (3 miles) north of the PGDP; ultimate discharge is into the Ohio River. Other surface-water bodies located in the area surrounding the PGDP include the Ohio River, Metropolis Lake, Crawford Lake, numerous small ponds, gravel pits, and settling basins.

At the PGDP, man-made drainage ditches receive storm water and effluent from the plant. These waters are routed through outfalls and eventually discharge into Bayou and Little Bayou creeks. The majority of the flow in these creeks can be attributed to effluent water from the plant. The 18 Kentucky Pollutant Discharge Elimination System (KPDES)-permitted outfalls have a combined average daily flow of 18.5 million liters per day (4.88 mgd) and are monitored by the PGDP.

2.5.1.2 Regional geology

The stratigraphic sequence in the region consists of Cretaceous, Tertiary, and Quaternary sediments unconformably overlying Paleozoic bedrock. At the PGDP, Paleozoic limestone bedrock is present at a depth of approximately 104 m (340 ft). The sequence of unconsolidated sediments overlying the bedrock consists of the following strata, in order of decreasing depth: the Tuscaloosa Formation, the McNairy Formation, the Porters Creek Clay, the Eocene Sands, the continental deposits, and surficial loess and/or alluvium. Figure 2-7 illustrates the relationships between the geologic horizons present in the vicinity of the PGDP.

The principal geologic feature in the PGDP area is the Porters Creek Clay Terrace, a large, low-angle, subsurface terrace trending approximately east-west across the southern portions of the plant. The terrace slope is located south of WAG 1 but directly underlies portions of the WAG 7 area. This terrace is believed to be the result of the erosion of the Porters Creek Clay by the ancestral Tennessee River. As a result of the erosion, the Porters Creek Clay is mainly absent from the PGDP area north of the terrace.

South of the Porters Creek Clay Terrace slope, the Porters Creek Clay is unconformably overlaid by either the Eocene Sands or the continental deposits. South of the terrace slope, the principal gravel facies within the continental deposits are Miocene-Pliocene gravels, referred to as terrace gravel deposits. The terrace gravel deposits are present overlying the Eocene Sands or, where the Eocene Sands are absent, directly on the upper surface of the Porters Creek Clay in the WAGs 1 and 7 area. North of the terrace slope, the McNairy Formation is directly overlaid by continental deposits. The continental deposits are informally subdivided into the Lower Continental Deposits, consisting of chert gravel in a matrix of sand and silt; and the Upper Continental Deposits, which consist of thin, interbedded layers of clayey silt, sand, and occasional gravel.

2.5.1.3 Regional ground-water hydrology

Several water-bearing zones are present in the PGDP area. South of the slope of the Porters Creek Clay Terrace, the principal water-bearing units, in order of increasing depth, are the terrace gravel, the Eocene Sands, and the McNairy Formation. However, the Eocene Sands were not encountered beneath any of the SWMUs within WAGs 1 and 7 and will not be discussed further. The primary water-bearing units north of the buried terrace are the Regional Gravel Aquifer (RGA), the Upper Continental Recharge System (UCRS), and the McNairy Formation.

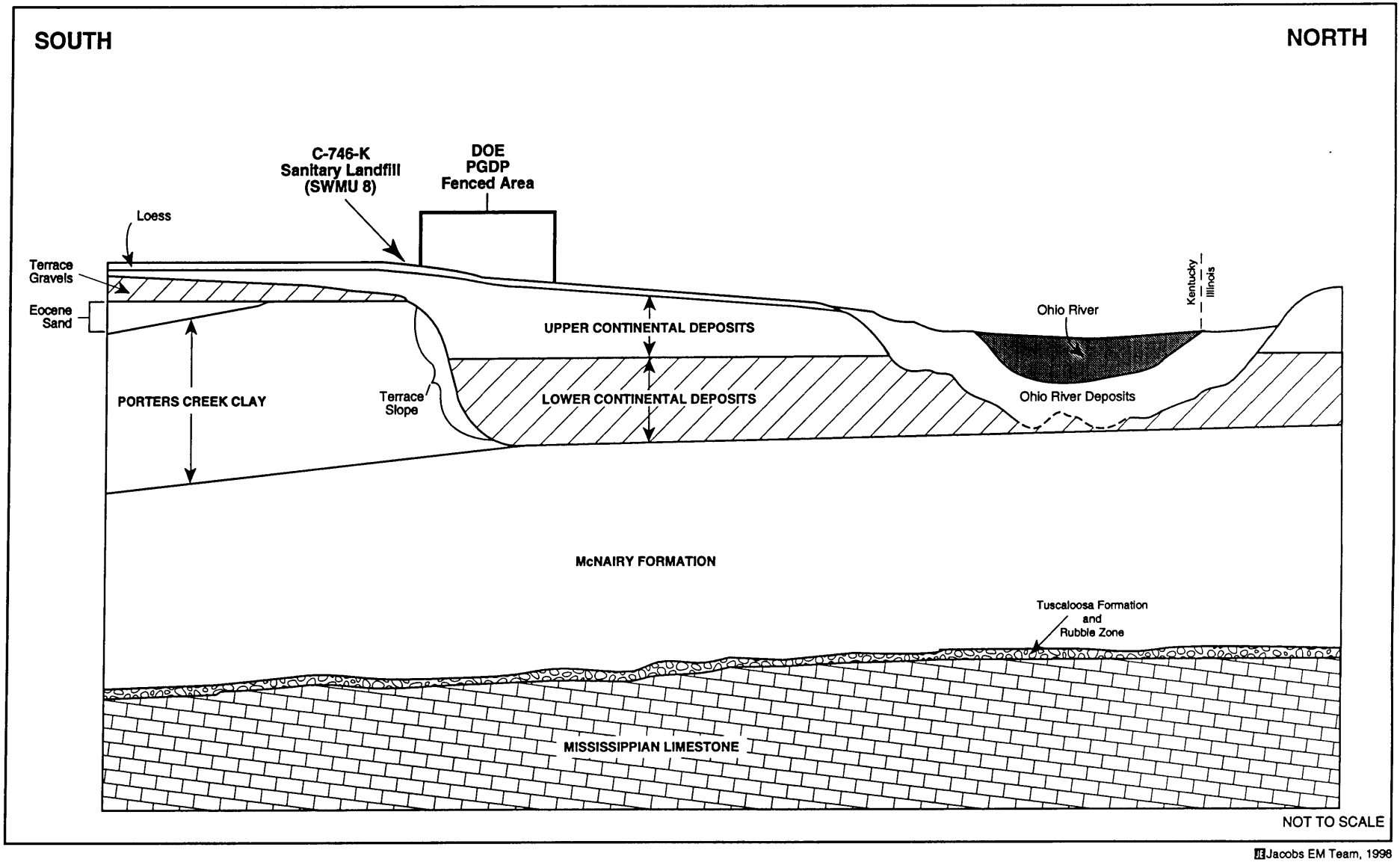


Figure 2-7. Schematic of Stratigraphic and Structural Relationships near the Paducah Gaseous Diffusion Plant

The RGA, defined as the uppermost aquifer at the PGDP, is present north of the Porters Creek Clay Terrace. The RGA consists of the lower gravel and sand facies of the continental deposits and also includes the sands of the upper part of the McNairy Formation where they are present directly below the RGA. The unit ranges in thickness from 3 to 12 m (10 to 40 ft) and pinches out at the base of the Porters Creek Clay Terrace slope. According to the 1990 Phase II and 1992 Phase III aquifer test reports conducted by the Terran Corporation, the hydraulic conductivity values determined by aquifer pump tests for the RGA range from 1.87×10^{-2} to 4.23×10^{-1} cm/sec (5.297×10^{1} to 1.093×10^{3} ft/day). Ground-water velocity within the RGA is estimated to range from 61 to 122 m/yr (200 to 400 ft/yr) to the north-northeast, toward the Ohio River, as noted in the *Remedial Investigation (RI) Addendum for Waste Area Grouping 22, Burial Grounds, at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* DOE/OR/07-1141&D1. Recharge to the RGA is primarily via infiltration from the Upper Continental Deposits and underflow from the Terrace Gravel.

The UCRS is present north of the Porters Creek Clay Terrace and consists of the Upper Continental Deposits and overlying loess. It includes sand and gravel lenses as well as the less permeable clay and silt matrix of the Upper Continental Deposits. The permeable lenses are relatively discontinuous laterally; hence, the flow direction in this unit is primarily vertical. A predominantly clay layer of varying thickness separates the UCRS sands and gravels from the underlying RGA in most areas of the plant's grounds. Immediately south of the Porters Creek Clay Terrace slope, the principal water-bearing unit within the continental deposits is the Terrace Gravel. The Terrace Gravel consist of interbedded gravel, sand, silt, and clay. Hydraulic conductivity values for the Terrace Gravel, determined from slug tests, range from 1×10^{-6} to 1.4×10^{-3} cm/sec (2.8×10^{-3} to 4.0 ft/day).

The Porters Creek Terrace slope is located south of the three SWMUs in WAG 1 (SWMUs 38, 100, and 136) but directly underlies portions of the WAG 7 area. The amount of ground-water flow over the slope has not yet been determined, but ground-water modeling conducted in support of the WAGs 1 and 7 Feasibility Study (FS) indicates that there is some degree of hydraulic connection between the RGA north of the terrace slope and the Terrace Gravel south of the terrace slope. The amount of connection is expected to vary as a function of the continuity of the shallow sand and gravel lenses over the terrace slope. In those areas of the slope where the permeable lenses are relatively continuous, such as where streams have deposited alluvium, the Terrace Gravel would be expected to transmit ground water laterally along the impermeable surface of the Porters Creek Clay to the continental deposits (including the RGA) north of the slope as well as to the alluvial deposits of nearby streams.

2.5.2 Hydrogeology of Waste Area Groups 1 and 7

Unless otherwise noted, the information presented in this section is derived from the *Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation Report for Waste Area Groupings 1 and 7 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* DOE/OR/07-1404&D2, and from the *Feasibility Study for Waste Area Groups 1 and 7 and Kentucky Ordnance Works Solid Waste Management Units 94, 95, and 157 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* DOE/OR/06-1416&D2.

2.5.2.1 Solid Waste Management Unit 100

Following are surface-water, surface-feature, and hydrogeologic descriptions for SWMU 100.

Surface features and surface water.

The ground surface at SWMU 100 is relatively flat, ranging in elevation from approximately 113 to 114 m (370 to 375 ft) amsl. Most of the ground surface is grass-covered, with the exception of the eastern part of the unit occupied by Fourth Street and a paved driveway. There are two drainage ditches at the site, a north-northeastern flowing drainage ditch located next to the railroad tracks at the western edge of the unit and a north flowing drainage ditch on the eastern edge of the unit adjacent to Fourth Street. A document issued by CDM Federal Programs Corporation in August 1994, *Investigation of Sensitive Ecological Resources Inside the Paducah Gaseous Diffusion Plant*, 716-0003-FR-BBRY, reports that wetlands have been identified in these drainage ditches. Runoff from the unit flows to the ditches and discharges via KPDES Outfall 016 to Bayou Creek, which is located approximately 305 m (1,000 ft) to the west.

Hydrogeology.

Eleven soil borings and two ground-water monitoring wells (MWs) were installed at SWMU 100 for the RFI/RI. The locations of these borings and monitoring wells, as well as the three soil borings (H216, H353, and H354) installed at SWMU 100 for the Phase II Site Investigation, are shown in Figure 2-3.

The following lithologies were encountered beneath the unit, in order of increasing depth: fill material, loess deposits, and the Continental Deposits. The uppermost water-bearing unit at this SWMU consists of about 8 m (25 ft) of sand and gravel in the Upper Continental Deposits. There is a clay aquitard near the base of the Upper Continental Deposits that is 2.9-m (9.5-ft) thick and occurs between approximately 17 to 19 m (54 to 63 ft) bls. The RGA is present at depths between 19 and 31 m (63 and 103 ft) bls. It consists of 1.2 m (4 ft) of sand overlying 11 m (35 ft) of sandy, pebble- to cobble-sized chert gravel.

The Porters Creek Clay may occur beneath this unit. Although SWMU 100 is located north of the Porters Creek Clay Terrace, it may overlie the extreme northern edge of the terrace slope where a thin layer of the clay is present. A stiff formation (possibly the Porters Creek Clay) was encountered in MW 330 at a depth of 31 m (103 ft) bls, but no lithologic sample was obtained.

According to water-level measurements collected July 15, 1994, in UCRS MW 315, the depth of shallow ground water at SWMU 100 is 2.45 m (8.04 ft) bls [111.9 m (367.22 ft) amsl]. The depth to water in MW 330, which is screened in the RGA, was approximately 12.8 m (42.1 ft) bls [101.3 m (332.3 ft) amsl].

2.5.2.2 Solid Waste Management Unit 136

Following are surface-water, surface-feature, and hydrogeologic descriptions for SWMU 136.

Surface features and surface water.

The ground surface at SWMU 136 is fairly level and ranges in elevation from approximately 113 to 114 m (371 to 374 ft) amsl. A 53-cm (21-inch) thick layer of compacted gravel covers the ground surface west and south of the pad, and plastic sheeting covers the excavated spill area. Two shallow depressions are located to the

south and southwest in the C-740 Material Yard. The nearest surface-water body is Bayou Creek, which is located approximately 457 m (1,500 ft) southwest of the unit. Runoff from SWMU 136 discharges to Bayou Creek via KPDES Outfall 008.

Hydrogeology.

Solid Waste Management Unit 136 is located north of the Porters Creek Clay Terrace where the Porters Creek Clay is absent. Five soil borings and three monitoring wells were drilled at SWMU 136 (Figure 2-3). None of the soil borings or monitoring wells at this unit were drilled to the depth of the McNairy Formation.

The following lithologies were encountered beneath the unit, in order of increasing depth: gravel and sand fill material, loess, and the continental deposits. The Upper Continental Deposits, consisting of up to 15 m (50 ft) of interbedded gravel, sand, clay, and silt, are present between 4 to 20 m (13.5 to 65 ft) bls. An 8-m (25-ft) thick aquitard, consisting of clay interbedded with thin silt and sand lenses, was encountered at the base of the Upper Continental Deposits at SWMU 136. Lower Continental Deposits are present beneath the unit at depths between 20 to 27 m (65 and 90 ft) bls.

According to water-level measurements collected July 15, 1994, the depth to the UCRS piezometric surface at SWMU 136 is approximately 1 m (3.29 ft) bls at MW 304. This well was screened from approximately 5 to 8 m (16 to 26 ft) bls. The depth to water in the two upper RGA wells (MWs 325 and 326) was approximately 12.5 m (41 ft) bls, or 101 m (332 ft) amsl.

2.5.2.3 Solid Waste Management Units 130 through 134

All of the C-611 USTs were found at depths less than 6 m (20 ft) bls, with the exception of the UST at SWMU 131, which could not be located.

Surface features and surface water.

The ground surface in the vicinity of the C-611 WTP gently slopes to the south and east and ranges in elevation from 112.8 to 121.9 m (370 to 400 ft) amsl. Surface features at the unit include the C-611-H WTP Building, the C-611-C Building to the south, a storage shed to the east, and a transformer to the west. In addition, four treatment lagoons are located immediately north of the C-611 WTP. The area immediately surrounding the buildings is mainly gravel-covered, except the asphalt- or concrete-paved areas at SWMUs 130 and 131, and the fenced, grass-covered area situated near SWMU 131. No surface water, floodplains, or wetlands have been identified within the boundaries of the C-611 UST area. Bayou Creek is located approximately 370 m (1,200 ft) east of the area and the unnamed tributary of Bayou Creek is located approximately 300 m (1,000 ft) south of the area. Surface runoff from the C-611 UST area is discharged via KPDES Outfall 006 to Bayou Creek.

Hydrogeology.

The USTs overlie the Porters Creek Clay Terrace at the approximate location of the terrace slope, where the slope dips relatively steeply to the north-northeast at an approximate gradient of 0.11 ft/ft. In this area, the continental deposits have not been differentiated into upper and lower members and are informally referred to as the Terrace Gravel or the Terrace Slope Gravels. Five soil borings and two monitoring wells were drilled at SWMUs 130 through 134 (Figure 2-4).

The following lithologies were encountered beneath the units, in order of increasing depth: fill material (composed of gravel and sand), loess, the continental deposits, and the Porters Creek Clay. The continental deposits (consisting of interlensing gravely clay; sandy gravel; and silty, clayey gravel) are present at these units from 5 m (17 ft) bls to below 14.9 m (49 ft) bls. The Porters Creek Clay was encountered, though not fully penetrated, in three soil borings at the units. The depth to the top of the clay varies from 4 m (13 ft) bls in the westernmost boring at SWMU 130 to 10 m (34 ft) bls in the south-eastern boring at SWMU 134.

The two monitoring wells installed at SWMUs 130 through 134 were completed in the Terrace Gravel. According to water-level measurements collected July 15, 1994, the depths to shallow ground water were approximately 2.3 m (7.5 ft) bls at MW 318 and 2.8 m (9.32 ft) bls at MW 317. Contouring of the water levels at WAG 7 (Figure 2-8) indicates the ground-water flow direction is to the east, toward Bayou Creek.

2.5.2.4 Solid Waste Management Unit 8

Following are descriptions of the surface-water and hydrogeologic conditions at SWMU 8.

Surface water.

Drainage ditches located along the western and northern edges of the landfill flow to the south into the unnamed tributary and to the east into Bayou Creek, respectively. A portion of the 100-year floodplain of Bayou Creek and the unnamed tributary is located within the boundary of SWMU 8. Wetlands were identified in the vicinity of SWMU 8 and are shown in Figure 2-5.

Hydrogeology.

Wehran Engineering drilled 10 soil borings at the landfill in 1980. Five of these were completed as piezometers (MWs 23 through 27) screened in the Porters Creek Clay. In addition, 10 test pits were excavated in and around the landfill, and polyvinylchloride plastic well points were installed in the backfill. As part of the Phase II Site Investigation, a soil boring (MW 183) and a monitoring well (MW 184) were installed in the Terrace Gravel at the landfill in 1991. For the RFI/RI, nine soil borings were drilled and four shallow monitoring wells (MWs 300 through 303) were installed around the perimeter of the landfill. None of the soil borings or monitoring wells at this unit fully penetrated the Porters Creek Clay. Figure 2-5 shows the locations of the sampling points at SWMU 8.

A cross section illustrating the geology at the landfill site is presented in Figure 2-9. The Porters Creek Clay Terrace slope dips relatively steeply to the north-northeast beneath the northeastern corner of the landfill. The following lithologies were encountered beneath the unit, in order of increasing depth.

- Landfill cap material occurs in the upper 0.6 to 0.9 m (2.0 to 3.0 ft) of the landfill. A 15- to 30-cm (6- to 12-inch) clay cap and a 46-cm (18-inch) layer of subsoil and topsoil were placed on the landfill in 1982, and additional soil was added when the cap was repaired in 1992. A thin layer of stiff, highly plastic white clay that fits the description of the original clay cap was encountered in soil borings 8-SB-002 and 8-SB-002A. Results of soil

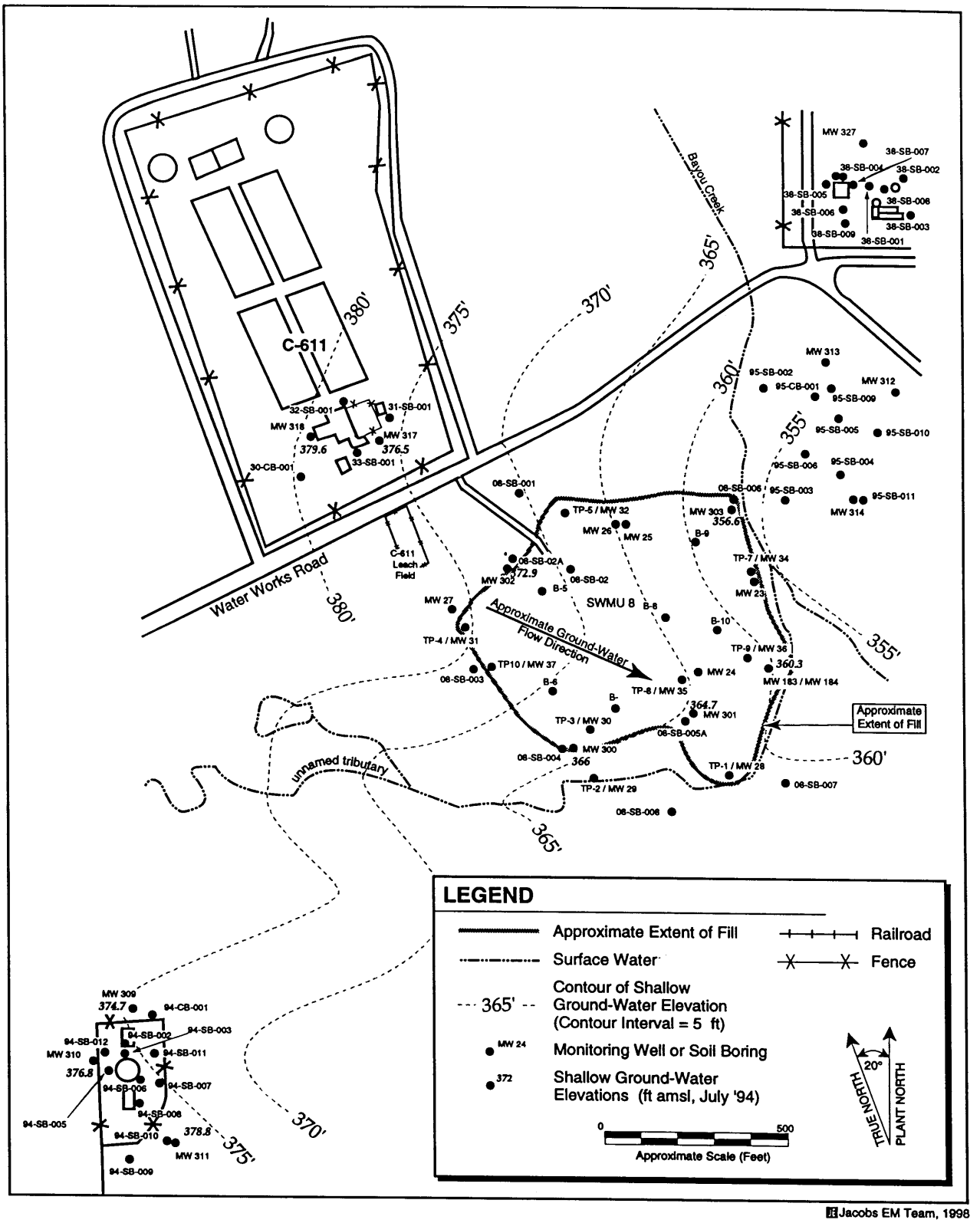


Figure 2-8. Shallow Ground-Water Flow Map for Waste Area Group 7

permeability testing on samples collected from the soils (vegetative cover) overlying the landfill cap range from an average hydraulic conductivity of 1.18×10^{-7} to 3.54×10^{-5} cm/sec (3.34×10^{-4} to 1.00×10^{1} ft/day).

- Fill material, composed of fly ash mixed with soil and assorted rubbish, is found beneath the clay and vegetative cap to a maximum observed thickness of 8.5 m (28 ft). In general, fly ash primarily consists of silt-sized particles of amorphous glass with quartz, mullite (aluminum silicate), various iron oxides such as hematite and magnetite, and lime according to the *Hydrogeologic Assessment of the C-746-K Landfill and Vicinity*, KY/ER-24.

- Loess and alluvial deposits are present in some areas underlying the landfill and range in thickness from 0 to 2 m (0 to 8 ft).

- Continental deposits consisting of up to 10 m (33 ft) of Terrace Gravel overlie the Porters Creek Clay Terrace at the landfill. The continental deposits consist of clayey silt containing coarse gravel and sand lenses and are difficult to distinguish from younger alluvial deposits near the creeks.

- The Porters Creek Clay underlies the landfill at varying depths. The depth to the top of the clay varies from 3.0 m (10 ft) bls in 8-SB-004 to 12.6 m (41.5 ft) bls in 8-SB-006. The Porters Creek Clay has been described as a dark, greenish gray to black clay containing varying amounts of silt and fine sand and displaying fine, hairline fractures. Results of tests conducted by Wehran Engineering in 1981 indicate that the hydraulic conductivity of the Porters Creek Clay ranges from 5.5×10^{-9} to 1.3×10^{-7} cm/sec (1.56×10^{-5} to 3.68×10^{-4} ft/day) at the landfill.

The UCRS and the RGA are not present at SWMU 8. Ground water occurs under shallow, unconfined conditions in the Terrace Gravel, loess, and alluvium overlying the Porters Creek Clay Terrace. Monthly ground-water levels measured at the landfill since 1980 indicate that ground-water levels vary seasonally, with the maximum levels typically occurring during winter and spring. Ground-water mounding occurs beneath the northwestern portion of the unit. Data collected in June 1992 indicate that the shallow water levels rise to about 115 m (377 ft) amsl beneath the western part of the landfill, indicating that the lower 2 to 3 m (5 to 10 ft) of waste at the landfill is below the water table during certain times of the year. According to water-level measurements collected July 12, 1995, the depths to shallow ground water range from approximately 1.6 m (5.4 ft) bls at MW 300 to 3.5 m (11.5 ft) bls at MW 303. Figure 2-8 presents a map of the piezometric surface at the landfill.

Underflow enters the landfill from the west within the Terrace Gravel, flows laterally to the east, and discharges into the creeks, with some unquantified amount potentially flowing into the RGA north of the terrace as recharge. North of the terrace slope, the predominant ground-water flow direction within the RGA is north-northeast. Ground-water flow modeling conducted for the FS at SWMU 8 was used to help define the probable shallow ground-water flow conditions at the landfill and to address the uncertainties regarding potential contaminant migration from SWMU 8 over the terrace slope into the RGA. According to the modeling results, under current (no action) conditions, approximately 0.66 l/sec (10.4 gpm) of the shallow ground water emanating from the landfill discharges to the creeks. This represents most of the shallow ground water flowing through the landfill, with the remainder of the flow, approximately 0.007 l/sec (0.10 gpm), discharging over the terrace slope into deeper layers. The results

of this modeling and the presence of the seeps in the surrounding surface water indicate that most of the shallow ground water at the landfill discharges to the surrounding creeks.

All available data have been used to describe the expected conditions at the C-746-K Sanitary Landfill. However, a degree of uncertainty remains concerning some of the site conditions at SWMU 8. These uncertainties include the degree of hydraulic connection between the Terrace Gravel and the RGA over the terrace slope and detailed information concerning the waste types and volumes at the landfill. An additional uncertainty is the exact location and condition of the KOW yellow-water line, an underground sewer line consisting of a 30.5-cm (12-inch) diameter vitrified clay pipe. The yellow-water line was used from 1942 to 1945 to transport yellow water, an acidic and trinitrotoluene (TNT)-contaminated waste water, from the KOW TNT manufacturing area to a discharge point on Bayou Creek. Maps of the KOW area indicate that sections of the KOW yellow-water line underlie the northern portion of the landfill site (Figure 2-5). The uncertainties are discussed in the FS and were considered during the development of the remedial alternatives for SWMU 8.

2.5.3 Operable Unit Characteristics

Following is a summary of the sampling results for the individual SWMUs.

2.5.3.1 Solid Waste Management Unit 100

Low levels of contamination were found in soil, sediment, surface-water, and ground-water samples collected at SWMU 100 (the FTA). Organic compounds detected at this unit include VOCs (toluene, xylene, and benzene) and polycyclic aromatic hydrocarbons (PAHs) commonly associated with waste oils and diesel fuels. They were detected at low concentrations in soil samples down to a depth of 4.6 m (15 ft) bls. However, no organic compounds were detected in ground-water, surface-water, or sediment samples indicating that these media are not impacted by organic contaminants migrating from SWMU 100. Twelve metals (aluminum, barium, cadmium, chromium, copper, iron, lead, magnesium, manganese, nickel, vanadium, and zinc) were detected at elevated concentrations in ground-water, surface-water, and sediment samples from the unit. Of these 12 metals, only three (barium, manganese, and vanadium) also were detected above background levels in surface and subsurface soils at the unit. This limited occurrence of metals in the soils at the unit indicates that SWMU 100 likely is not a significant source of metals contamination.

Radionuclides (^{99}Tc, uranium, and thorium) were detected in soil, sediment, surface-water, and ground-water samples from SWMU 100. Their widespread occurrence and low activities indicate their presence likely is related to plant activities rather than past activities at this SWMU.

The areal extent of impacted soils at SWMU 100 has been estimated as approximately 720 m^2 (7,750 ft^2) according to the WAGs 1 and 7 FS, DOE/OR/06-1416&D2. The horizontal extent of organic and inorganic contamination in soils is restricted to depths above 4.6 m (15 ft) and 7.6 m (25 ft) bls, respectively. The limited extent and low concentrations of organics and metals contamination at this unit may represent residual contamination from the waste oils or fuels burned at the unit.

2.5.3.2 Solid Waste Management Unit 136

Results of the RI conducted at SWMU 136, the TCE Spill Site, indicate that several organic contaminants are present above background levels in soil and ground water at the unit. Soil samples from SWMU 136 were found to contain low levels of VOCs [TCE, 1,1-DCE, 1,1,1-trichloroethane (TCA), and 1,2-DCA] and several PAHs. Ground-water samples at the unit also contained organic contaminants. The maximum concentration of TCE in ground water was detected in a UCRS hydraulic probe sample collected from soil boring 36-SB-004 at 442 µg/l. The highest TCE concentration observed in the RGA wells at the unit (110 µg/l) was detected in a sample from a downgradient well (MW 325). Another organic compound detected in the ground-water samples was 1,1,1-TCA, (4,472 µg/l), which was detected in a UCRS temporary well sample, but was not detected at concentrations above 5 µg/l in samples from the adjacent UCRS monitoring well (MW 304).

Soil and ground-water samples were also found to contain metals and radionuclides at levels above background. Four metals [antimony (1.7 mg/kg), chromium (29 mg/kg), barium (439 mg/kg), and mercury (3.2 mg/kg)] were detected above background concentrations in soils at the unit. Several metals were detected above background levels in ground water. Samples from UCRS MW 304 contained iron, manganese, silver, zinc, sodium, and aluminum above background concentrations. Ground-water samples collected from the RGA wells contained barium, manganese, and zinc above background levels. The radionuclide ^{99}Tc was found above background values in the samples collected from all three monitoring wells at the unit. The levels of ^{99}Tc ranged from 1.27 to 12.21 pCi/l.

The observed contamination in soil and ground water at the unit indicates that the spill site is a likely source of organic contamination. Trichloroethene and other chlorinated hydrocarbons have migrated below the water table at the unit into the UCRS and the RGA, leaving residual contamination in the surface and subsurface soils at the unit. However, the low concentrations of TCE detected in ground-water samples at the unit do not indicate the presence of dense nonaqueous phase liquid. The areal extent of the organic and metals contamination at the unit has been estimated as approximately 17.7 m^2 (190 ft^2) according to the WAGs 1 and 7 FS, DOE/OR/06-1416&D2.

2.5.3.3 Solid Waste Management Units 130 through 134

A sample was collected from the tank residuals of both SWMUs 130 and 134. The location of SWMU 131 could not be determined, and SWMUs 132 and 133 had been filled with sand and grout, respectively. Both samples contained lead, benzene, toluene, ethylbenzene, and xylene as well as other VOCs and PAHs associated with petroleum products. Low levels of lead, VOCs, and PAHs also were detected in soil samples from the C-611 UST area. The only VOC detected was 1,4-dichlorobenzene (3 µg/l), which was detected in ground-water samples collected from MW 317, the downgradient (eastern) shallow monitor well. The only PAH detected was naphthalene (70 µg/l), and it was found in the well upgradient of the site (MW 318). Lead, the only metal for which analysis was completed in the two monitoring wells, was not detected in ground water.

Low levels of radionuclides, including uranium-235 (^{235}U), uranium-238 (^{238}U), neptunium-237 (^{237}Np), thorium-228 (^{228}Th), thorium-232 (^{232}Th), ^{99}Tc, and plutonium-238 (^{238}Pu), were detected in soil and ground-water samples collected in the area. No radionuclides were detected above background levels in the UST liquids. The presence of these radionuclides in soils and ground water is likely unrelated to any of the USTs, but the presence more likely is the result of plant-wide activities. The organic and lead

contamination observed at SWMUs 130, 132, 133, and 134 appears to be limited in areal extent [35.3 m^2 (380 ft^2)] and may be indicative of past gasoline, diesel, or fuel-oil spills in the area.

2.5.3.4 Solid Waste Management Unit 8

Soil, ground-water, surface-water, sediment, and leachate sampling was conducted at the landfill for the RFI/RI. Eight soil borings and four shallow ground-water monitoring wells, MWs 300 through 303, were installed around the perimeter of the landfill. Five surface-water samples, seven sediment samples, and three leachate samples were collected during the RFI/RI from the locations shown in Figure 2-5.

Results of the RI conducted at the landfill indicate that low levels of various organic compounds, metals, and radionuclides are likely leaching from the wastes buried in the landfill into the nearby streams and to ground water. Leachate samples collected from two shallow holes on the bank of the unnamed tributary south of the landfill indicate that the pH of the leachate ranges from 2.3 to 3.4 prior to mixing with stream water. Where the acidic leachate from the landfill enters the creeks, the pH rises to approximately 6, indicating that the leachate only slightly lowers the stream pH when they mix. The low pH causes dissolved metals, particularly iron and aluminum, to form a precipitate. The precipitation of iron and aluminum oxy-hydroxides is the suspected cause of the orange to yellow staining observed seasonally at various seep sites at the landfill. The staining is most intense during dry periods (late summer to early fall) when stream flow is low. Specific conductance values for the stream samples are also typically higher during the dry season and range up to approximately 2,000 µmhos/cm. The measured hardness for surface-water samples at the landfill varies from 36 to 1,085 mg/l calcium carbonate ($CaCO_3$). The detailed results of the sampling can be found in the RFI/RI for WAGs 1 and 7.

Inorganics.

Numerous metals (including aluminum, antimony, beryllium, chromium, cobalt, iron, magnesium, manganese, selenium, thallium, and vanadium) were detected above background levels in soils at the unit. The metals aluminum, beryllium, cobalt, iron, magnesium, manganese, nickel, and zinc also were detected above background levels in all four monitoring wells. (The concentrations of these metals were lower in the upgradient well, MW 302, than in the downgradient wells.) Many metals (aluminum, beryllium, calcium, cobalt, iron, magnesium, manganese, mercury, nickel, sodium, and zinc) also were detected above background levels in the leachate samples, indicating that the landfill likely is one source of the metals. Surface-water samples collected for the RFI/RI contained numerous metals at concentrations above background levels; however, according to the United States Geological Survey report, *Study and Interpretation of the Chemical Characteristics of Natural Water*, only two, antimony and cadmium, were present at concentrations above those typical of natural waters. The elevated antimony concentration was detected in an upstream surface-water sample and, therefore, likely is not due to the landfill. Cadmium was detected in surface-water sample 08-SW-003, as well as in some leachate samples, at concentrations higher than the expected range for natural waters. This suggests that the landfill is a probable source of the elevated cadmium levels. Although several metals were detected in sediment samples from SWMU 8, the only metal detected above background levels was iron (47.3 mg/kg). The extent of the metals contamination in surface water appears limited to the areas upgradient of sampling location 08-SW-003.

The cause of the acidic pH of the landfill leachate has not been firmly established. A study by the Illinois State Geological Survey indicates that low pH, under some conditions, is due to the presence of high concentrations of sulfate in the fly ash. The pH of the leachate is low enough to cause the dissolution of metals. The source of some of the metals detected at elevated levels in ground water and leachate samples at the landfill is likely due to the fly ash. However, the elevated levels of iron and manganese also may be a result of the interaction of the acidic pH with the Terrace Gravel deposits, which often have a dark brown coating, or patina, of iron and/or manganese oxides in the PGDP area.

Radionuclides.

Low levels of the radionuclides, ^{99}Tc, ^{235}U, uranium-234 (^{234}U), ^{238}U, ^{228}Th, thorium-230 (^{230}Th), ^{232}Th, and ^{237}Np were detected levels in soils. The radionuclides ^{237}Np, ^{238}Pu, ^{99}Tc, ^{228}Th, ^{232}Th, ^{234}U, ^{235}U, and ^{238}U were detected above background levels in the leachate samples from SWMU 8. The highest activities were detected at a seep on the northern bank of the unnamed tributary, south of the landfill. Surface-water samples from two locations at SWMU 8 contained radionuclides: $^{233/234}U$ (0.45 pCi/l), ^{235}U (0.31 pCi/l), and ^{238}U (0.2 pCi/l) at 08-SW-003 and $^{233/234}U$ (0.32 pCi/l) at 08-SW-005. Very low levels of radionuclides were detected in the downgradient shallow ground-water samples from MWs 300, 301, and 303. (No radionuclides were detected above background levels in the upgradient well, MW 302.) The contaminated rubbish reportedly disposed in the landfill is a potential source of these contaminants.

Organics.

Very low levels of VOCs were detected in the surface and subsurface soil samples at the landfill. Benzene (21 µg/kg) was detected in surface and subsurface soils at soil boring 08-SB-001 at the northeastern edge of the landfill. A possible source of the benzene, as indicated by old photographs, was the bulldozers parked in the area during landfill operations. Additional VOCs, including 1,2-DCE, carbon tetrachloride, and toluene, were detected but at concentrations below the quantitation limit. Numerous PAHs were detected in shallow soils but, with the exception of the PAHs detected in 08-SB-001, the concentrations of the PAHs were less than the quantitation limit. The surface-soil sample at soil boring 08-SB-001 had a total PAH concentration of 9,160 µg/kg. Two polychlorinated biphenyls (PCBs) were detected at the landfill: (1) Aroclor-1254, detected from the 1.52 to 3.05 m (5.0 to 10.0 ft) bls intervals in SB-006 at a concentration of 2,082 µg/kg; and (2) Aroclor-1260, detected in the surface soils at 08-SB-004 at a concentration of 183 µg/kg. Although these appear to be isolated occurrences of PCBs at the landfill, PCBs are still considered potential landfill contaminants.

The VOCs TCE (27 µg/l); 1,1-DCA (23 µg/l); 1,1-DCE (18 µg/l); and 1,2-DCE (330 µg/l) were detected in MW 300 during RFI/RI sampling activities. Two of these VOCs (1,1-DCA and 1,2-DCE) also were detected in MW 301. Additional sampling of MWs 300 through 303 was conducted in March 1995 and results indicated the presence of cis-1,2-DCE (790 µg/l); 1,1-DCE (72 µg/l); 1,1-DCA (61 µg/l); and TCE (52 µg/l). Two of the leachate samples contained the organic compounds TCE; 1,2-DCA; xylene; 1,1-DCE; and 1,2-DCE. No organic compounds were detected in the sediment samples or surface-water samples collected during the RFI/RI at the unit. However, one organic [cis-1,2-DCE (9 µg/l)] has been detected in a surface-water sample collected from PGDP stream sampling point C-746-K-3A, located southeast of the landfill within the unnamed tributary. The presence of VOCs in the ground-water and leachate samples indicate they likely are leaching from the landfill.

2.5.4 Contaminant Characteristics

The conceptual site model presented in Figure 2-10 illustrates source area contamination, primary and secondary contaminated media, transport pathways, exposure pathways, and receptors that may be associated with releases of contamination from SWMU 8. The source at SWMU 8 consists of fly ash; uncontaminated, combustible waste; potentially-contaminated rubbish; and trash. From the source at SWMU 8, contamination has migrated to primary contaminated media, soil and shallow ground water, via infiltration, leaching, erosion, and runoff. From the primary media, contaminants are migrating to sediments adjacent to SWMU 8, a secondary contaminated medium. Migration pathways also may transport contaminants to other secondary contaminated media including air, leachate, soil, surface water, and deep ground water. As illustrated in the conceptual site model, contamination from SWMU 8 is migrating primarily through the release of leachate at seeps next to the unnamed tributary. The environmental exposure contaminant pathways of potential concern are illustrated in Figure 2-11.

Ground water is included in the conceptual site model to identify it as a contaminated medium. However, receptors and exposure pathways are not identified in the model since the preferential pathway of contaminant transport from the unit is via the shallow ground-water system to the surface. Additionally, while the remedial action taken does not impact ground water, any future remedial action, if necessary, will be undertaken as part of the ground water CSOU. Air is included in the model to identify it as a secondary contaminated medium; however, there are no receptors or exposure pathways identified, since SWMU 8 is outdoors and the likelihood of exposure to contamination via the air pathway outdoors is minimal.

Potential current exposure to contaminants in the source or other primary media at SWMU 8 is limited since the unit is capped. However, potential risks to industrial workers exist at SWMU 8 through direct contact with the secondary contaminated medium (sediments). Additionally, there is a potential for humans or animals to come into direct contact with acidic leachate being released from the landfill into sediments above the water level in the creeks (Figure 2-10 is based on risk assessment results and does not include potential risks to any receptor that may come into direct contact with the acidic leachate). The selected remedial action for SWMU 8 is intended to reduce the potential for direct contact with contaminated sediments and acidic leachate associated with the unit, thereby reducing associated risks. The risks addressed by the selected remedy are discussed in the following section.

2.6 SUMMARY OF SITE RISKS

Solid Waste Management Unit 38 is an operating facility, therefore, an evaluation of remedial options for the unit will be deferred until it ceases operation. At SWMUs 130 through 134 and the soils of SWMU 136, risks and hazard indices (HIs) for human health and animals do not exceed threshold values; therefore, these units require no further action. Any contaminated ground water associated with SWMU 136 will be evaluated as part of the ground water CSOU (WAG 26).

Risks for industrial workers slightly exceed EPA thresholds at SWMUs 8 and 100 (please refer to the FS in the WAGs 1 and 7 AR for more detail regarding risk thresholds); however, these risks are due to direct contact with surface water and sediments contaminated with metals. As discussed in the FS for WAGs 1 and 7, DOE/OR/06-1416&D2, the direct contact exposure pathway is associated with

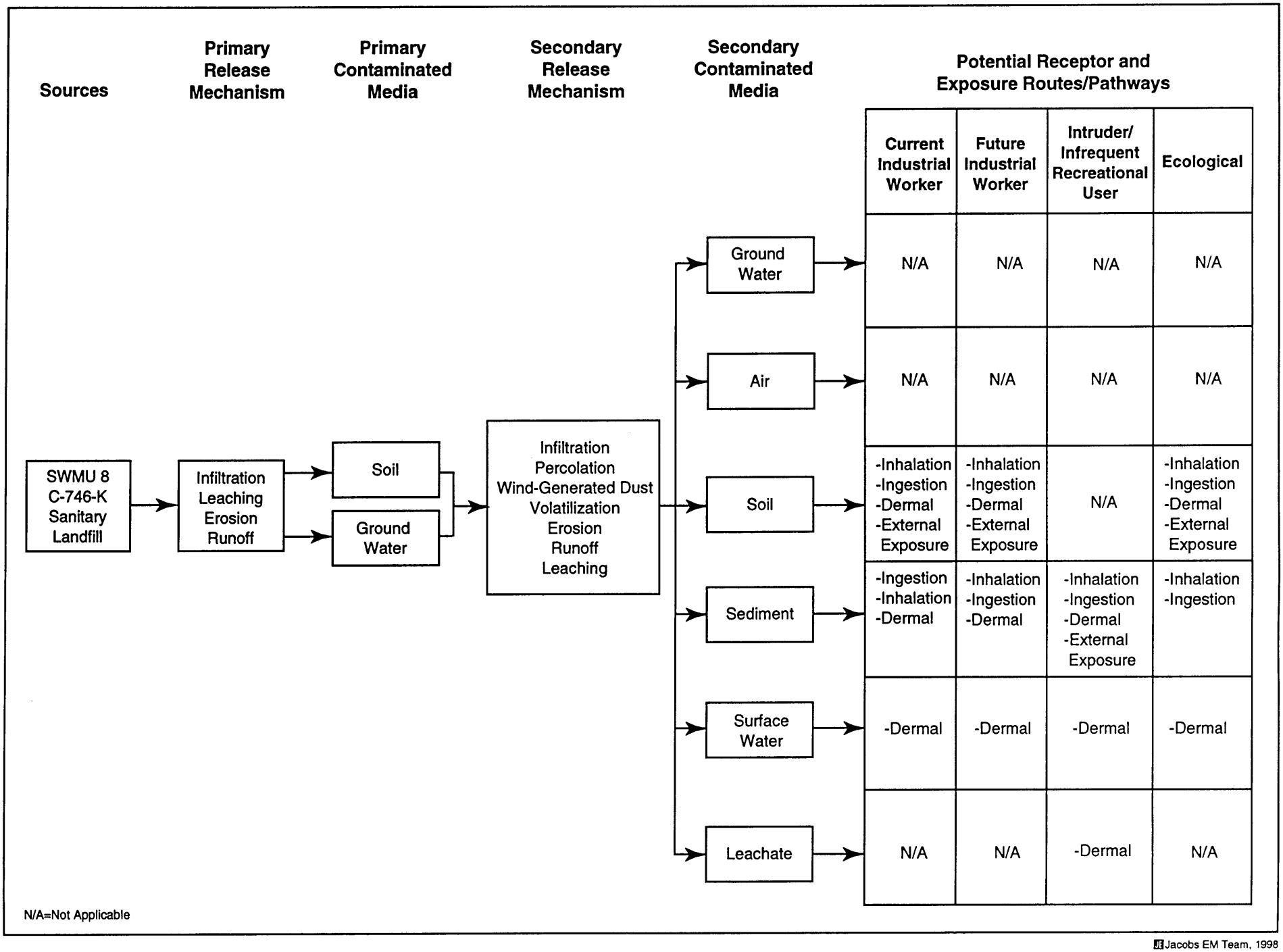
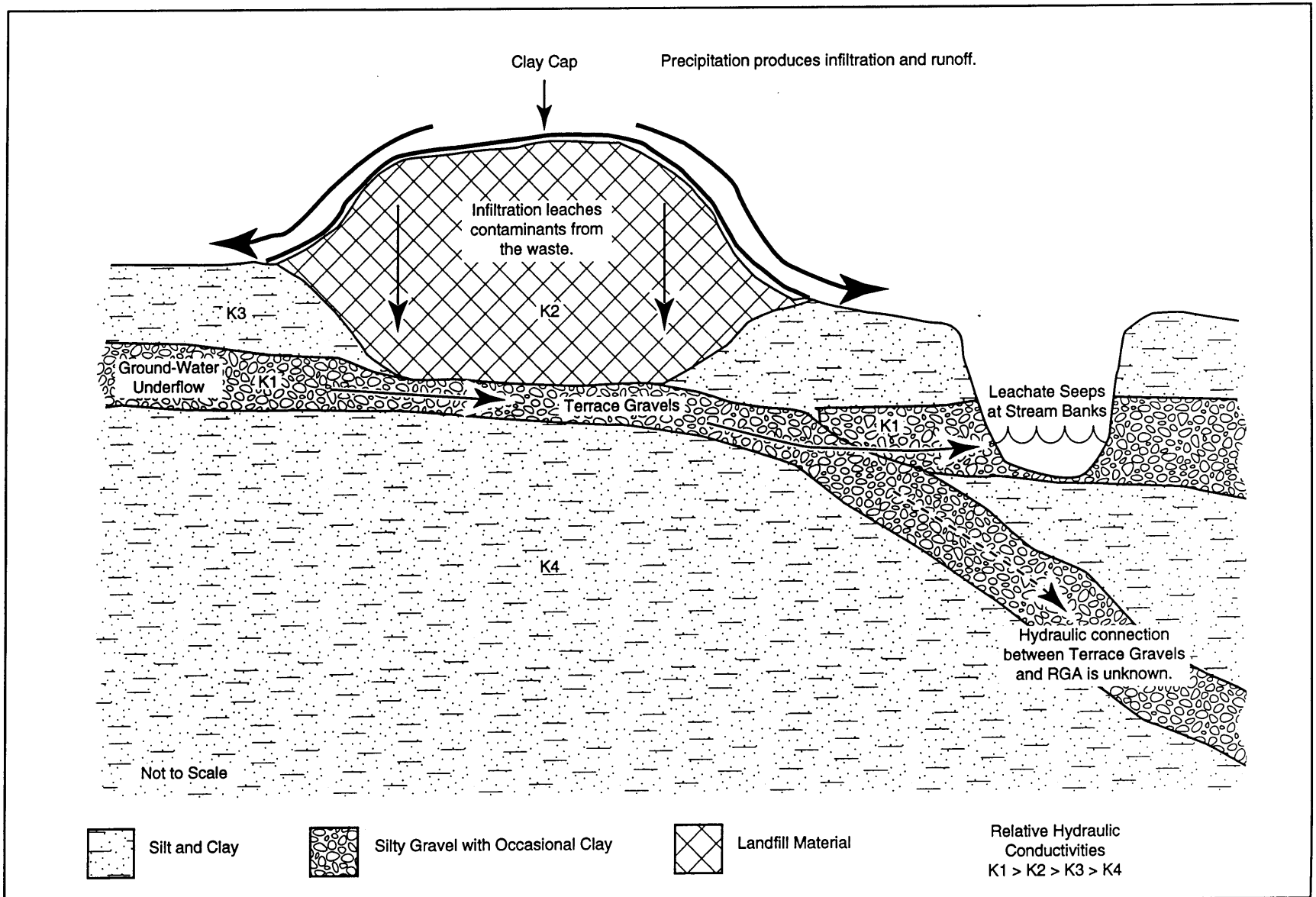


Figure 2-10. Conceptual Site Model for Solid Waste Management Unit 8 of Waste Area Group 7



(Modified from DOE/OR/07-1404&D2)

Jacobs EM Team, 1998

Figure 2-11. Contaminant Pathways from Solid Waste Management Unit 8

numerous uncertainties (such as conservative assumptions associated with absorption of metals). This uncertainty causes an overestimation of risks. For example, only dissolved metals are variably absorbed through the skin. The RI assumed that the total concentration of metals (including both dissolved and suspended is available for absorption). Therefore, the dermal pathway typically should not be used as the sole pathway in making remedial decisions (refer to the FS for a more detailed discussion of the uncertainties associated with the risk assessment). Additional evaluation of potential risks are considered in the following paragraphs.

As discussed in Appendix C, actual exposures to workers in the ditches at SWMU 100 (approximately 2 days/yr for 8 hours/day, for 25 years) are significantly less than the default exposures used in the baseline risk assessment (i.e., 250 days/yr for 8 hours/day for 25 years). This exposure is consistent with very limited activities such as those associated with periodic maintenance of drainage ditches (i.e., weed eating). Under this assumption, cancer risk to industrial workers potentially exposed to contaminated sediments and surface water at rates consistent with actual exposure rates at SWMU 100 approach *de minimus* (i.e., $1x10^{-6}$) at $2x10^{-6}$ (which means 2 additional cancers out of a population of 1,000,000 could occur following prolonged exposure). Further, the maximum concentrations of the primary contaminant (beryllium) in the two ditches surrounding SWMU 100 (called SWMU 100a and SWMU 100b in the RI report), contributing most to the above risk estimate, are below or only slightly exceed the natural background level for beryllium (0.83 mg/kg in SWMU 100a and 0.64 mg/kg in SWMU 100b, compared to a background level of .67 mg/kg). These concentrations do not indicate gross contamination related to activities associated with the PGDP. Finally, since these areas are ditches, activities at SWMU 100 are expected to remain consistent with the actual exposure rate in the future. Consequently, no further action, outside of maintaining institutional controls, is required to protect workers at SWMU 100. Currently contaminated surface water will be addressed on a site-wide basis during the surface-water CSOU investigation.

While contaminant conditions at SWMUs 8 and 100 are similar, there also is a risk that a human or animal could come into direct contact with acidic leachate being released from SWMU 8 into sediments above the water level in the creeks. These risks, when combined with the NOV issued by the Kentucky Department for Environmental Protection, Division of Water (KDOW), indicate that limited action is necessary at SWMU 8 to protect human health and animals.

2.6.1 Human Health Risk Assessment

As previously discussed, SWMU 100 does not require action, other than maintaining land use and activity patterns. Therefore, this section summarizes risk information relative to SWMU 8 that does require some form of remedial action to address contamination.

Data from the site investigation are evaluated in the human health risk assessment. To identify chemicals of potential concern (COPCs), all constituents detected in the surrounding sediments, soils, surface water, and ground water are evaluated using established guidelines. From this data, COPCs have been identified including metals, organic compounds, and radionuclides.

The potential for human contact with contaminants is evaluated in the exposure assessment. Since PGDP security limits access by the general public to SWMU 8 with signs and a security patrol and the area is anticipated to remain industrialized in the future, exposure is most appropriately characterized under an industrial scenario. For this scenario, the primary exposure pathway is dermal absorption as a result of industrial workers coming into direct contact with contaminated sediments in the creeks for extended periods of time (8 hours/day, 250 days/year, for 25 years). Since SWMU 8 is located outside the main industrial plant, a revised exposure rate (i.e., an actual exposure rate as for SWMU 100) is not considered. Potential future releases from the unit to ground water are evaluated using predictive models to estimate leaching.

The toxicity assessment evaluates adverse effects to human health resulting from exposure to chemicals of concern (COCs). Chemicals of concern in sediment at SWMU 8 are antimony, arsenic, beryllium, iron, manganese, and vanadium. Arsenic and beryllium exhibit characteristics of carcinogens and noncarcinogens and may cause cancer and various other adverse effects through prolonged exposure. Antimony, iron, manganese, and vanadium are noncarcinogens, but may cause various adverse health effects through prolonged exposure.

The risk characterization indicates that under current conditions, only SWMU 8 warrants an action. Table 2-1 provides a summary of carcinogenic risks and noncarcinogenic HIs at SWMU 8 and the exposure pathways of concern. The risks and HIs for sediment for both the current and future worker exceed EPA threshold values (please refer to the FS in the WAGs 1 and 7 AR for more detail regarding risk thresholds). The COCs identified for sediment are those that contribute most of the risks and HIs for a pathway of concern.

Table 2-1. Summary of Risks at Solid Waste Management Unit 8

Exposure Pathways	Current Industrial Worker	Future Industrial Worker
	Excess Lifetime Cancer Risk	
Sediment		
Dermal Absorption	3×10^{-4}	3×10^{-4}
Sum of Pathways	3×10^{-4}	3×10^{-4}
	Chronic Hazard Index	
Surface-Water		
Dermal Absorption	1	1
Sediment		
Dermal Absorption	5	5
Sum of Pathways	7	7

2.6.2 Ecological Risk Assessment

The screening ecological risk assessment for SWMU 8 indicates that current ecological impacts in Bayou Creek are minimal. No analytes exceed benchmark values (please refer to the RI included in the WAGs 1 and 7 AR for more information regarding ecological benchmarks) used to assess potential impacts to aquatic species in surface water; however, sediments in Bayou Creek contain elevated concentrations of arsenic, chromium, and manganese.

While concentrations of these analytes exceed benchmark levels, adverse impacts appear to be very low, which may indicate a level of sediment contamination that can be tolerated by most benthic organisms. The leachate in Bayou Creek also exceeds terrestrial benchmarks for the ingestion of surface water, but this calculation assumed 100% ingestion from the seeps. Risks associated with Bayou Creek should decrease as remedial actions are taken to prevent direct contact with the leachate and contaminated sediments. Analyte concentrations in sediments also should decrease as less-contaminated sediments are deposited. Also, since contaminant concentrations in landfill soils exceed terrestrial benchmarks, the current landfill cap should be maintained in order to protect terrestrial wildlife from exposure.

Uncertainties are associated with the screening ecological risk assessment for SWMU 8. While evaluation may suggest adverse impacts to ecological receptors, no measurable effects are seen in the field. Screening assessments are considered final assessments only when they indicate that there are no potential hazards to ecological receptors. However, any cumulative effects of small losses or contamination of terrestrial habitat will be more fully assessed on a facility-wide basis in the PGDP baseline ecological risk assessment for the surface-water CSOU.

2.6.3 Remedial Action Objectives

Results of the risk analysis indicate that SWMU 8 poses an unacceptable risk to industrial workers and animals via direct contact with acidic leachate emanating from the unit. The remedial action objectives for this unit are to control the release of COCs from the unit, limit direct contact by humans, and reduce overall risks to ecological receptors. The action implemented at SWMU 8 will satisfy these objectives by limiting human and animal exposure to contaminated sediments and acidic leachate associated with the unit. The reduction of human risks will be accomplished by posting warning signs and by placing a deed notice and restrictions on the SWMU 8 property. The reduction of ecological risks will be accomplished by installing riprap over exposed acidic leachate seeps.

2.7 DESCRIPTION OF ALTERNATIVES

The following paragraphs present a description of the alternatives evaluated for each of the SWMUs of concern in WAGs 1 and 7.

2.7.1 Description of Alternatives for Solid Waste Management Unit 8 (C-746-K Sanitary Landfill)

The following subsections provide descriptions of individual alternatives evaluated for SWMU 8.

2.7.1.1 Alternative 1 — No Action

Pursuant to 40 C.F.R. § 300.430(e) of the NCP, the DOE is required to consider a no action alternative. This alternative serves as a baseline to which the other alternatives are compared. Under this alternative, current institutional actions (i.e., existing ground- and surface-water monitoring, landfill cap maintenance, etc.) would be continued; however, no further remedial actions would be conducted at this SWMU.

This alternative would not include implementation of any treatment technologies, contaminant containment, institutional controls, or storage of wastes or residual materials. Costs associated with this alternative include the preparation of five-year review reports, mandated by Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) § 121(c) [42 U.S.C.A. 9621(c)], at those sites where contamination remains at levels that allow for unlimited use and unrestricted exposure.

2.7.1.2 Alternative 2 — Upgradient Subsurface Barrier

This alternative consists of the installing a subsurface barrier upgradient of the landfill in order to divert uncontaminated ground water from landfill wastes. In addition, a deed notice and restrictions would be placed upon the landfill property to restrict future land use.

Since hydrogeologic data from the *Hydrogeologic Assessment of the C-746-K Landfill and Vicinity* suggests that the current ground-water table saturates up to 1.2 m (4 ft) of the landfill wastes, implementation of subsurface barrier technology would result in a reduction of the volume of landfill leachate generated. In addition, diversion of ground water around the landfill may decrease contaminant transport through the ground-water migration pathway. The subsurface barrier design calls for approximately 427 m (1,400 linear ft) of 60 mil (0.15 cm or 0.06 inch) high-density polyethylene (HDPE) sheeting installed to a maximum depth of 9.1 m (30 ft). The wall would be anchored into the Porters Creek Clay unit, which has a permeability on the order of 10^{-9} cm/sec (2.55 x 10^{-5} ft/day). Low-permeability slurries, such as a bentonite slurry, would be placed at the lower 0.6-m (2-ft) interval at the bottom of the excavation to alleviate the potential for ground water to flow under the barrier wall.

Most of the residual soil generated from trenching would be used as trench backfill. Remaining trench soil generated from the trenching would require treatment, storage, or disposal, as the potential exists that these residual materials may be contaminated with landfill wastes. Current estimates indicate 222 m^3 (290 yd^3) of soil generated from trench excavation would require management as a nonhazardous waste.

In addition to constructing a subsurface barrier, a deed notice and restrictions would be placed in the chain of title to restrict the use of the property. Institution of a deed notice and restrictions would supplement containment actions in achieving a reduction of contaminant exposure pathways for potential receptors by restricting land application (e.g., farming and residential use) and prohibiting destruction of existing and future contaminant containment controls (e.g., existing landfill cap and upgradient barrier). Current DOE administrative controls, including requirements for work permits, would be continued. Current surface-water monitoring and landfill cap maintenance activities would be continued. The existing ground-water monitoring program may be modified, if required, to include the installation of additional monitoring wells as part of this remedial action. The DOE would conduct reviews of the action no less than once every five years, since contaminants would remain in the unit. Estimated costs and a summary of the detailed evaluation of this alternative are presented in Section 2.8 of this ROD.

2.7.1.3 Alternative 3 — Downgradient Leachate Collection System

This alternative consists of the installation of a downgradient leachate collection system, composed of a French drain system located downgradient of the landfill, and a filter for treatment of the collected leachate. Construction of a leachate collection system would reduce the migration of leachate escaping from the landfill by accumulation, treatment, and subsequent discharge to surface water. The leachate collection system would consist of approximately 427 m (1,400 linear ft) of trench excavated to a depth of 7.3 m (24 ft) bls. Perforated HDPE pipe would be embedded in a column of gravel (nonreactive river stone or pea gravel), wrapped by a layer of filter fabric, and then backfilled with a 1.2-m (4-ft) thick layer of clay at the top of the trench to minimize infiltration. Two 1.2-m (4-ft) polyethylene manhole sumps would be installed to collect the leachate. The perforated laterals would be welded to the manholes to transport leachate to the sumps. Leachate would be removed from the sumps using submersible pumps which are activated by leachate elevation.

The leachate would then be pumped through a dual-stage filter to remove particulate matter. The filter stages would consist of a limestone stage to buffer the leachate and precipitate the metals, and a packed-sand stage to remove the particulate matter prior to discharge. Treated leachate would be discharged to Bayou Creek. Discharge would be monitored to meet the substantive requirements of a KPDES-permitted outfall.

Current estimates indicate 633 m^3 (827 yd^3) of soil generated from trench excavation likely may be contaminated with landfill wastes; therefore, this material would require management as a nonhazardous waste. Any remaining uncontaminated trench residuals would be spread on SWMU 8 and seeded.

In addition to the construction of a leachate collection system, a deed notice and restrictions would be placed in the chain of title to restrict the use of the property. Institution of a deed notice and restrictions would supplement containment actions in achieving reduction of contaminant exposure pathways for potential receptors by restricting land application (e.g., farming and residential) and prohibiting destruction of existing and future contaminant containment controls (e.g., existing landfill cap and leachate collection system). Current DOE administrative controls, including requirements for work permits, would be continued. Current surface-water monitoring and landfill cap maintenance activities would be continued. The existing ground-water monitoring program may be modified, if required, to include installation of additional monitoring wells as part of this remedial action. The DOE would conduct reviews of the action no less than once every five years, since contaminants would remain in the unit. Estimated costs and a summary of the detailed evaluation of this alternative are presented in Section 2.8 of this ROD.

2.7.1.4 Alternative 4 — Full Perimeter Subsurface Barrier

This alternative consists of the installation of a full perimeter subsurface barrier and two RGA monitoring wells downgradient of the landfill. Since hydrogeologic data from the *Hydrogeologic Assessment of the C-746-K Landfill and Vicinity* suggests that the current ground-water table saturates up to 1.2 m (4 ft) of the landfill wastes, implementing subsurface barrier technology would result in a reduction of the volume of landfill leachate generated. In addition, the diversion of ground water around the landfill may decrease contaminant transport through the ground-water migration pathway. The subsurface barrier wall would be installed to a depth of 6.1 m (20 ft) on the western portion of the landfill, and 9.1 m (30 ft) on the eastern portion of the landfill to tie the

bottom of the wall into the confining clay layer underlying the landfill. Approximately 823 m (2,700 linear ft) of subsurface barrier would be necessary to fully encompass the wastes. The wall would be anchored into the Porters Creek Clay unit, which has a permeability on the order of 1×10^{-9} cm/s (2.5×10^{5} ft/day). Low-permeability slurries, such as a bentonite slurry, would be placed at the lower 0.6-m (2-ft) interval at the bottom of the excavation to alleviate the potential for ground water to flow under the barrier wall.

Most of the residual soil generated from trenching would be used as trench backfill. Remaining trench soil generated from the trenching would require disposal, as the potential exists that these residual materials could be contaminated with landfill wastes. Current estimates indicate that 621 m^3 (812 yd^3) of soil generated from trench excavation would require management as a nonhazardous waste.

The current ground-water monitoring program would be expanded to include the two new RGA ground-water monitoring wells; sampling and analytical event frequency and parameters for these two new wells are anticipated to be the same as for the ground-water monitoring wells currently used for environmental assessment at the site.

In addition to the construction of a subsurface barrier, a deed notice and restrictions would be placed in the chain of title to restrict the use of the property. Instituting a deed notice and restrictions would supplement containment actions in achieving a reduction of contaminant exposure pathways for potential receptors by restricting land application (e.g., farming and residential) and prohibiting destruction of existing and future contaminant containment controls (e.g., existing landfill cap and full-perimeter barrier). Current DOE administrative controls, including requirements for work permits, would be continued. Current surface-water monitoring and landfill cap maintenance activities would be continued. The existing ground-water monitoring program may be modified, if required, to include the installation of additional monitoring wells as part of this remedial action. The DOE would conduct reviews of the action no less than once every five years, since contaminants would remain in the unit. Estimated costs and a summary of the detailed evaluation of this alternative are presented in Section 2.8 of this ROD.

2.7.1.5 Alternative 5 — Constructed Wetland Treatment System

This alternative consists of installing a constructed wetland treatment system downgradient of the landfill within the channels of the adjacent creeks to intercept and treat landfill leachate. The wetland treatment system would consist of a sheet-pile wall constructed beyond the northern and western embankments of the adjacent creeks which would contain the wetland treatment system. This downgradient location would allow the treatment system passively to intercept and treat the landfill leachate. The base of the treatment system would be contoured, and soil amendments (e.g., mushroom compost, organic material, and limestone) to buffer pH would be installed as a wetland substrate. Wetland substrate would be built-up within the containment wall so that seepage from the bank of the landfill to the wetland system would remain subsurface, and initial treatment would occur during flow through the reactive substrate.

The wetland treatment system would be seeded with native wetland vegetation; volunteer vegetation also would be allowed to emerge within the treatment system. In order to maintain hydrologic connection between the creeks and the wetland, "weep" holes would be cut intermittently in the sheet piling above the elevation of the wetland. A weir would be placed at the downgradient end of the wetland to allow discharge from any impounded water within the wetland system. Discharge would be monitored to

evaluate compliance with the substantive requirements of a KPDES outfall. In addition to constructing a wetland treatment system within the creek, the opposing channel bank will be cut and filled, as necessary, to straighten the channel and minimize erosion. No residual materials would be generated from such bank work, as any excavated material would be used as fill material within the channel.

In addition to the installation of a constructed wetland treatment system, a deed notice and restrictions would be placed in the chain of title to restrict the use of the property. Institution of a deed notice and restrictions would supplement treatment actions in achieving a reduction of contaminant exposure pathways for potential receptors by restricting land application (e.g., farming and residential) and prohibiting destruction of existing and future contaminant containment controls (e.g., existing landfill cap and constructed wetland). Additionally, warning signs will be posted notifying the public of the potential risks at the site.

This alternative would be implemented as a full-scale treatability study for the first two years of operation. As such, the treatment system would be monitored for specific parameters at a set frequency to determine its effectiveness. Current ground-water monitoring may be modified, if required, to include the installation of additional monitoring wells as part of this remedial action. The current surface-water sampling and analysis program would be modified from quarterly monitoring at five locations to monthly monitoring at one location at the effluent point of the treatment system, and one in-stream location downgradient of the treatment system within Bayou Creek. Current DOE administrative controls, including requirements for work permits, would be continued. The DOE would conduct reviews of the action no less than once every five years, since contaminants would remain in the unit. Estimated costs and a summary of the detailed evaluation of this alternative are presented in Section 2.8 of this ROD.

2.7.1.6 Alternative 6 — Limited Action

This alternative consists of placing riprap along the northern bank of the unnamed tributary at any visible leachate seep locations to minimize the potential for exposure, and along the western bank of Bayou Creek to reduce erosion during high flow events. Signs warning workers and trespassers of the potential risks to human health would be installed along the creek and at the entrance to the landfill site. Institutional controls, including ground-water and surface-water monitoring, would continue. Additional ground-water monitoring wells would be installed, as needed.

In addition to installing signs and placing riprap within the creek channel, a deed notice and restrictions would be placed in the chain of title to restrict the use of the property. Instituting a deed notice and restrictions would supplement institutional controls in achieving a reduction of contaminant exposure pathways for potential receptors by restricting land use (e.g., farming and residential) and prohibiting destruction of existing and future contaminant containment controls (i.e., the existing landfill cap). Estimated costs and a summary of the detailed evaluation of this alternative are presented in Section 2.8 of this ROD.

2.7.2 Description of Alternatives for Solid Waste Management Units 100, 130 through 134, and 136

Risks under the industrial land use scenario for human receptors at SWMU 100 are associated with many uncertainties, and remediating environmental media at this unit would not be practicable for this reason. Currently, institutional controls enacted at the PGDP include security fencing and patrols to prevent unknowing and unauthorized

entry to the plant and risk management procedures to prevent worker exposure to contaminated media. A risk management evaluation indicated that these institutional controls reduced exposure potential to acceptable levels for plant workers (see the risk evaluation provided as Appendix C). Therefore, the remedy for this unit is the continuation of plant institutional controls.

The risk analysis indicated that no unacceptable risks exist for all use scenarios for human receptors at SWMUs 130 through 134 and for the soils of SWMU 136. Potential risks for the ecological receptors are limited since all these SWMUs are located within a fenced industrial area, and habitat for terrestrial wildlife and plants is limited. Therefore, no further action will be required for SWMUs 130 through 134 and 136.

Since contamination will remain in place at SWMU 100 and in order to evaluate the reliability of controls in providing protection, five-year reviews will be required at this unit as mandated by CERCLA § 121(c) [42 U.S.C.A. § 9621 (c)]. No five-year reviews will be conducted for the remaining SWMUs as the risk assessment concludes no residual risks exist at these sites.

2.8 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

This section provides the basis for determining which alternative: (1) meets the threshold criteria of overall protection of human health and the environment, and compliance with applicable or relevant and appropriate requirements (ARARs); (2) provides the best balance between effectiveness and reduction of toxicity, mobility, or volume through treatment, implementability, and cost; (3) satisfies state and community acceptance; and (4) is consistent with the Kentucky Hazardous Waste Management Permit.

Nine criteria are required by the CERCLA for evaluating the expected performance of remedial actions. The remedial alternatives have been evaluated based on the nine criteria, which are identified in the following list.

(1) *Overall protection of human health and the environment.* This threshold criterion requires that the remedial alternative adequately protect human health and the environment, in both the short and long term. Protection must be demonstrated by the elimination, reduction, or control of unacceptable risks.

(2) *Compliance with ARARs.* This threshold criterion requires that the alternatives be assessed to determine if they attain compliance with ARARs of both federal and state law.

(3) *Long-term effectiveness and permanence.* This primary balancing criterion focuses on the magnitude of residual risk and the adequacy and reliability of controls used to manage remaining waste (untreated waste and treatment residuals) over the long term (i.e., after remedial objectives are met). Remedial actions that afford the highest degree of long-term effectiveness and permanence are those that leave little or no waste at the site, make long-term maintenance and monitoring unnecessary, and minimize the need for institutional controls.

(4) *Reduction of contaminant toxicity, mobility, or volume through treatment.* This primary balancing criterion is used to evaluate the degree to which the alternative employs recycling or treatment to reduce the toxicity, mobility, or volume of the contamination.

(5) *Short-term effectiveness.* This primary balancing criterion is used to evaluate the effect of implementing the alternative relative to the potential risks to the general public, potential threat to workers, potential environmental impacts, and the time required until protection is achieved.

(6) *Implementability.* This primary balancing criterion is used to evaluate potential difficulties associated with implementing the alternative. This may include technical feasibility, administrative feasibility, and the availability of services and materials.

(7) *Cost.* This primary balancing criterion is used to evaluate the estimated costs of the alternatives. Expenditures include the capital cost, annual O&M, and the combined net present value of capital and O&M costs.

(8) *State acceptance.* This modifying criterion requires consideration and incorporation of any comments on the ROD from the Commonwealth of Kentucky.

(9) *Community acceptance.* This modifying criterion provides for consideration of any formal comments from the community on the PRAP.

2.8.1 Overall Protection of Human Health and the Environment

An alternative must meet this threshold criterion to be eligible for selection. As discussed in Section 2.6, this final action is necessary to address potential risks posed by SWMU 8. Alternative 1 does not meet this criterion since it does not address the risks at these units. Alternative 2 would meet this criterion because it reduces the release of COCs and chemicals of potential ecological concern (COPECs) to surface water via leachate seepage. Alternatives 3 and 4 would meet this criterion by preventing the migration of COCs and COPECs into Bayou Creek and the unnamed tributary. Alternative 5 would meet this criterion by limiting direct contact with the waste and by eliminating the release of COCs and COPECs into Bayou Creek and the unnamed tributary. Finally, Alternative 6 would meet this criterion by limiting direct contact with contaminated sediments and acidic leachate associated with the unit.

2.8.2 Compliance with Applicable or Relevant and Appropriate Requirements

An alternative must meet the CERCLA threshold criterion of complying with ARARs, or be waived, to be eligible for selection as a remedial action. The remainder of this section describes how well each of the alternatives addressed in this ROD meets this criterion. No ARAR will be waived for any alternative addressed in this ROD. However, consistent with the deferral of the potential remedial actions for the surface water and ground water at WAGs 1 and 7 to the CSOUs for surface water and ground water, respectively, the ARARs for the remediation of these water bodies will be addressed in the CSOUs. A detailed description of ARARs for the selected remedy is presented in Section 2.10 of this ROD.

2.8.2.1 Solid Waste Management Unit 8

For SWMU 8, Alternatives 2 (Upgradient Subsurface Barrier), 3 (Leachate Control), 5 (Constructed Wetland), and 6 (Limited Action) would meet all chemical-, action-, and location-specific ARARs. Alternative 4 (Full-Perimeter Subsurface Barrier) would not meet all action-specific ARARs, as the alternative would result in an increased flow of

contaminants to the RGA. This would run counter to the intent of 401 K.A.R. 5:037, which is to prevent the pollution of ground water. Finally, Alternative 1 (no action) was not evaluated for ARARs compliance because the action does not meet the first threshold criterion of protecting human health and the environment.

The FS for WAGs 1 and 7 stated that Alternative 2 would not meet chemical-specific ARARs. The statement was made because Alternative 2 would not prevent all leachate from reaching Bayou Creek and its unnamed tributary. Since the 1992 NOV from the KDEP (discussed further in Section 2.2.2.2 of this ROD) indicated that it considered the leachate to be violating Kentucky standards for protecting the environment, the DOE concluded that the alternative would not meet chemical-specific ARARs. However, as is further discussed in Section 2.10.1.1 of this ROD, the KDEP does not now consider the leachate to be harming the creeks.

2.8.2.2 Solid Waste Management Units 100, 130 through 134, and 136

Pursuant to the CERCLA guidance document, *ARARs Q's & A's*, EPA Office of Solid Waste and Emergency Response, 9234.2-01FS, May 1989, an evaluation of compliance with ARARs for a No Further Action decision is not required to be included in a ROD. This is because a no action decision may only be made when the site being evaluated has been determined to be protective of human health and the environment. Since it has been determined that SWMUs 130 through 134 and 136 are already protective of human health and the environment, no action will be undertaken at these SWMUs, and ARARs compliance evaluations for the SWMUs are not included in this ROD.

Since the continuation of controls is necessary at SWMU 100 to protect human health and the environment adequately under an industrial land-use setting, the SWMU must undergo an ARARs analysis. As is further discussed in Section 2.10.4, the selected remedy for SWMU 100 meets all ARARs.

2.8.3 Long-Term Effectiveness and Permanence

Alternatives 2, 3, 4, 5, and 6 are designed to limit exposure to site-related contaminants in the soil and from leachate generated by the landfill. Alternative 1 would produce the greatest residual risk since no action would be taken.

Alternatives 2, 3, 4, 5, and 6 would provide adequate reliability and controls if properly designed and installed. Alternative 5 may require maintenance of the wetland treatment system if significant hydrologic events at the unit were to erode the system. Since no action is involved, Alternative 1 would produce the least reliability and control.

The deed notice and restrictions that would be implemented as part of Alternatives 2, 3, 4, 5, and 6 would limit how the DOE or any successive owner of the SWMU 8 property could use the land. Additionally, under Alternative 6, the DOE would post and maintain warning signs around the landfill to inform workers and any trespassers of the potential risks posed by the site.

Long-term monitoring of surface and ground water is required for all the alternatives. As mandated by the CERCLA, five-year reviews are required for Alternatives 1, 2, 3, 4, 5, and 6 because untreated waste would remain onsite.

2.8.4 Reduction of Contaminant Toxicity, Mobility, or Volume

Alternative 5 achieves a reduction of toxicity, mobility, and volume of contamination by treatment in a wetland. Alternative 3 would reduce the volume, mobility, and toxicity of contaminants by capturing and treating the landfill leachate reaching the creeks. Alternatives 2 and 4 would reduce the mobility and volume of the landfill leachate; however, Alternative 4 increases the mobility and volume of contaminants reaching the RGA. Alternatives 2, 4, and 6 do not include treatment. While Alternative 6 does not provide a reduction of the toxicity, mobility, or volume of the contaminants, it reduces the exposure potential by limiting site use and exposure potential.

2.8.5 Short-Term Effectiveness

Negative impacts to community protection are not anticipated for Alternatives 2, 3, 4, 5, or 6. Alternatives 2, 3, 4, 5, and 6 may pose minimal risks to workers during implementation. The probability of an accident would be rather low due primarily to the short lengths of time involved in construction activities. In considering exposure routes, consistent with the baseline risk assessment for a future excavation worker, short-term risks are not expected to exceed acceptable limits for Alternatives 2, 3, 4, 5, or 6.

Alternatives 2, 3, and 4 would not pose unacceptable environmental impacts during implementation since best management practices would be enacted and sensitive resource areas would be avoided. Wetlands associated with the unnamed tributary and Bayou Creek for Alternatives 5 and 6 could be disturbed during construction; this disturbance would be permissible under Nationwide Permit (NWP) 38 (Cleanup of Hazardous and Toxic Wastes).

Since no action is involved, Alternative 1 would not require any time to complete. For Alternatives 3, 5, and 6, remedial action objectives would be achieved subsequent to construction activities. For Alternatives 2 and 4, a decrease in the volume of leachate generated by the landfill would occur subsequent to diverting ground-water flow; a reduction in the volume of leachate generated would require draining of the saturated wastes.

2.8.6 Implementability

Alternatives 2, 3, 4, 5, and 6 would require readily available services and materials and would be technically and administratively feasible to implement. No permits would be required for Alternatives 2, 3, 4, 5, and 6. Alternative 5 would require coordination with the COE due to construction activities within wetlands associated with the unnamed tributary and Bayou Creek; less than one acre of wetlands would be impacted by implementation of this alternative. This disturbance is permissible under NWP 38. Additionally, for Alternatives 3, 5, and 6 the substantive requirements of the KPDES program would have to be met.

2.8.7 Cost

Estimated capital, 30-year O&M, and total contingency costs for each alternative are presented in Table 2-2. The total cost and 30-year present worth values for each alternative also are presented in the table.

Table 2-2. Preliminary Cost Estimates

($ in Thousands)						
Remedial Alternative	1	2	3	4	5	6
Capital Cost	$0	$1,909	$3,140	$2,521	$2,322	$340
O&M Cost	$48	$48	$2,827	$805	$637	$60
Contingency Cost	$12	$489	$1,493	$831	$443	$6
Total Cost	$60	$2,446	$7,460	$4,157	$3,402	$406
Present Worth*	$22	$2,405	$5,203	$3,527	$2,951	$350

*Present worth assumes a 7% discount rate.

2.8.8 State Acceptance

The remedial action described herein will be conducted in compliance with the PGDP Hazardous Waste Management Permit, KY8-890-008-982, issued by the KDEP, and with federal environmental requirements. The DOE has issued the WAGs 1 and 7 RI, FS, PRAP, and this ROD to the KDEP and the EPA for review. Pursuant to Section 121(e)(2) [42 U.S.C.A § 9621(e)(2)] and the draft FFA, the EPA must approve the ROD prior to its implementation and the KDEP may provide its concurrence.

2.8.9 Community Acceptance

As further discussed in Section 2.3 and the Responsiveness Summary of Section 3 of this ROD, the public has been provided the opportunity to comment on the selected remedial action, and it has done so. No member of the public stated opposition to the selected remedial action; however, public comments on the effectiveness, cost, and compliance with the CERCLA were received. All comments from the public were considered in the selection of the remedial action. A summary of the public's comments and the DOE's responses to them are contained in the Responsiveness Summary.

2.9 SELECTED REMEDY

Based upon the evaluation of the alternatives utilizing the nine CERCLA criteria, the remedy for SWMU 8 that best meets the threshold, balancing, and modifying criteria for the scope and objectives is Alternative 6, limited action. This remedial action provides for overall protection of human health and the environment, complies with ARARs, poses no additional risks to the community during implementation and is cost effective. Impacts to workers and sensitive resources are limited during implementation.

The selected remedy for SWMU 8 will consist of the following elements, at a minimum.

(1) Install warning signs. Signs will be posted at the entrance to the landfill site and along the creeks, visible at any access point to the landfill, that clearly state the potential risks to human health posed by the leachate seeps and contaminated sediments in the creeks. The signs will be designed to be resistant to the elements. Figure 2-12 depicts the approximate locations of the signs at the landfill site.

(2) Place riprap. Riprap will be placed along the creek banks at the apparent seep locations along the unnamed tributary and Bayou Creek to minimize erosion. The riprap will be sized appropriately to reduce the potential to be displaced during high flow events.

(3) Institute a deed notice and restrictions. A deed notice and restrictions will be placed in the chain of title to the deed of the property to inform potential buyers and/or users of the potential risks to human health and the environment posed by the leachate seeps and the controls implemented at the site to minimize potential exposure. Additionally, the deed restrictions legally will bind the buyer to restricted uses of the property.

(4) Continue the existing surface-water monitoring program. As part of the interim corrective measures taken at SWMU 8, surface-water monitoring includes four sampling points along Bayou Creek and the unnamed tributary adjacent to the landfill (Figure 2-12). Samples are collected at various periods ranging from once per week to once per quarter and are reported to the EPA and the KDEP on a semiannual basis. The surface-water parameters tested for include aluminum, arsenic, barium, cadmium, gross alpha and beta, hardness, hexavalent chromium, pH, and iron. (For more information on surface-water sampling at SWMU 8, see the C-746-K Sanitary Landfill semiannual reports available to the public through the DOE Environmental Information Center, 175 Freedom Boulevard, Kevil, Kentucky 42053.)

Also, as part of the interim corrective measures taken at SWMU 8, DOE will continue to monitor four sampling points along Bayou Creek and the unnamed tributary adjacent to the landfill. Further interim actions will be implemented if monitoring indicates that additional remedial activity is necessary. These measures will continue until such time as the Division of Water implements a discharge permit that allows for monitoring of landfill discharges and protection of the environment afforded by the permit conditions. At that time, criteria set forth in the permit for monitoring will be adhered to, and current monitoring practices will be discontinued.

(5) Modify the ground-water monitoring program. Ground-water monitoring at the C-746-K Sanitary Landfill currently includes quarterly sampling of five shallow ground-water wells located around the periphery of the unit (MWs 300 through 303 and MW 184). The results of the ground-water sampling conducted at the unit are reported in the C-746-K Sanitary Landfill Semiannual Reports, which are issued in accordance with the Interim Corrective Measures Workplan for the C-746-K Sanitary Landfill.

In support of the limited action remedy, the following modifications to the ground-water monitoring program at the landfill will be implemented.

Monitoring Well 303 no longer will be monitored and a replacement well, MW 303A, will be installed. Monitoring Well 303 was not screened at the appropriate depth to sample the lower portion of the Terrace Gravel deposits. The new well will be located in the vicinity of MW 303 and will be screened to the base of the Terrace Gravel deposits. Initially, samples will be collected from the new monitoring well on a quarterly basis in order to

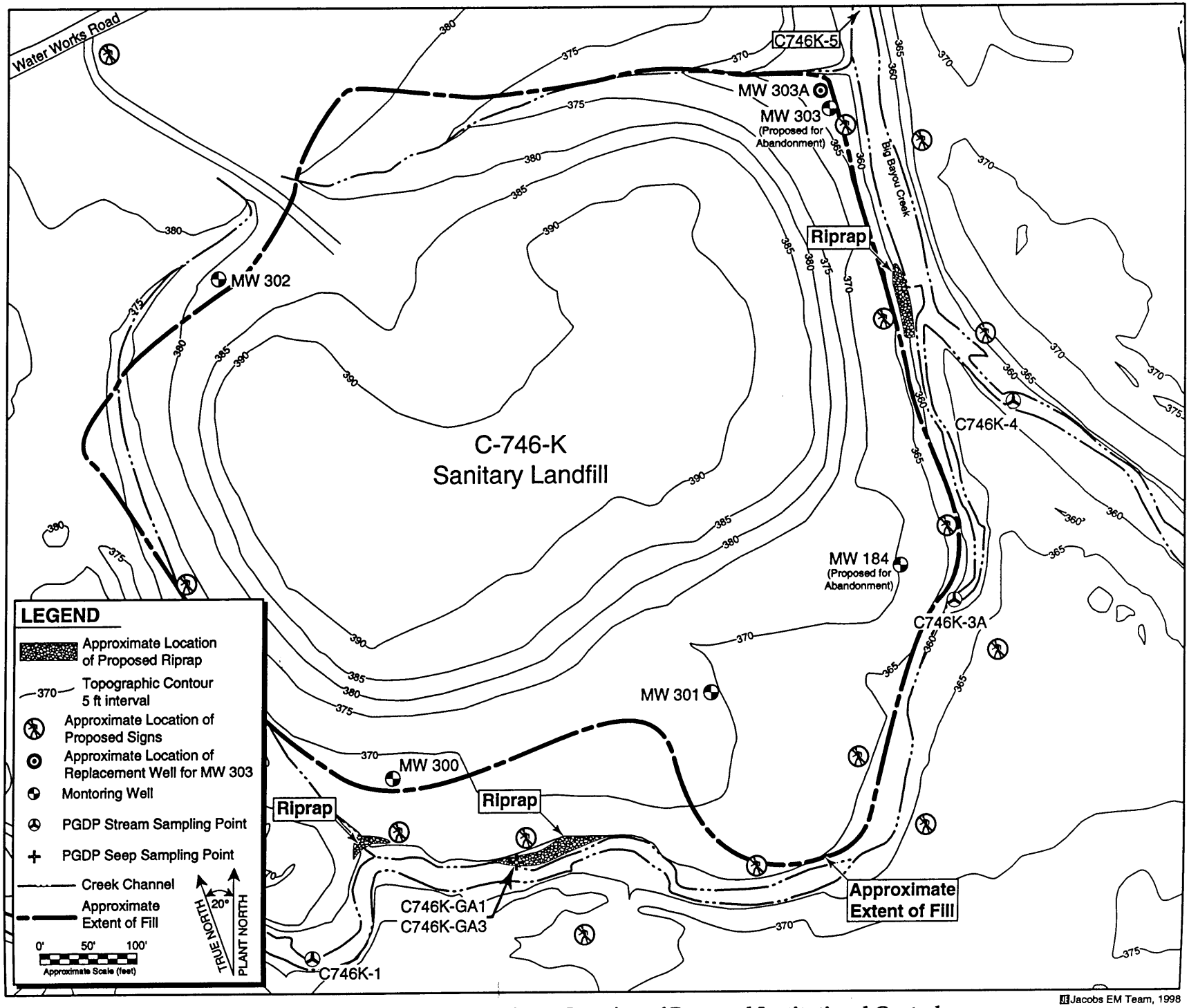


Figure 2-12. Approximate Location of Proposed Institutional Controls

- discern seasonal variations in contaminant levels. In accordance with the Sampling and Analysis Plan (SAP) Addendum, KY/ER-2, the new well will be monitored for the parameters established under the environmental surveillance (new monitoring well) program. The parameters analyzed and frequency sampled will be reevaluated after one year and any necessary modifications will be documented in the annual update to the SAP Addendum.

- Monitoring Well 184 no longer will be monitored. This well was installed in 1991 in support of the Phase II Site Investigation. There are two reasons for ceasing the monitoring of MW 184: (1) the well is usually dry, and (2) the sampling is unnecessary due to the four high-quality wells (MWs 300, 301, 302, and 303A) that will be monitored at the landfill.

The ground-water monitoring results will be reported to the EPA and the KDEP in the PGDP semiannual reports prepared by the DOE management and the operating contractor. If ground-water monitoring detects contamination, an assessment will be conducted to determine if an interim remedial action is necessary. The final remedial action for the landfill's impact to the Ground Water Integrator Unit will be selected and implemented as part of WAG 26, which is the Ground Water Integrator Unit investigation. The RI/FS workplan for WAG 26 is due to the regulatory agencies May 15, 2007.

In addition to those actions outlined in the preceding paragraphs, the current landfill cap maintenance program will be continued. The DOE will prepare a detailed design for this remedial action in accordance with the requirements specified in the Declaration of this ROD. During design and construction activities, some changes may be made to the remedy, as described here, as a result of the design and construction processes. Changes such as these modifications can result from the engineering design process.

This action will provide overall protection of human health and the environment. It also can be implemented in compliance with ARARs. Potential human and animal exposure to contaminated sediments and the acidic landfill leachate will be reduced as a result of implementation of this remedial action. As shown in Table 2-2, the total estimated cost for Alternative 6, limited action, is $406,000.

2.9.1 Statutory Determination

The remedial actions, described herein are protective of human health and the environment, are cost effective and comply with federal and state requirements that are legally applicable or relevant and appropriate to the WAGs 1 and 7 SWMUs. The selected remedies for the WAGs 1 and 7 SWMUs do not satisfy the CERCLA § 121(b) [42 U.S.C.A. § 9621(b)] statutory preference for having, as a principal element, treatment that results in a permanent and significant reduction of toxicity, mobility, or volume, because risk analysis indicates that such remedies are not necessary. The selected remedies do, however, satisfy the CERCLA § 121(b) statutory preference for using permanent solutions and alternative treatment technologies to the extent practicable.

Since contamination will remain at SWMUs 8 and 100 above levels that allow for unlimited use and unrestricted exposure under the industrial land-use setting of the affected properties, five-year reviews will be conducted pursuant to CERCLA § 121(c) [42 U.S.C.A. § 9621(c)] and 40 C.F.R. § 300.430(f)(4)(ii). Five-year CERCLA reviews will not be conducted at SWMUs 130 through 134 and 136 because the selected

remedial actions allow for unlimited use and unrestricted exposure. Finally, because the remedial action decision for SWMU 38 is being deferred, five-year reviews for the SWMU are not herein addressed.

2.9.2 Protection of Human Health and the Environment

The selected action at SWMU 8 protects PGDP employees and the public by posting warning signs and plant security patrols of the landfill area. The limited action remedy also will reduce risks to humans and animals through limiting leachate exposure by placing riprap over acidic leachate being released above the water level in the creeks and by restricting future land use.

Continuation of controls at SWMU 100 protects the public by ensuring that current exposure assumptions are maintained in the future through institutional controls, including the PGDP perimeter security fence.

2.10 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

This section of the ROD discusses the concepts of ARARs and to be considered (TBC) information, as created by the CERCLA, and how the selected remedial action is expected to fare against the ARARs and TBC information.

2.10.1 Introduction to Applicable or Relevant and Appropriate Requirements and To Be Considered Information

Congress specified in CERCLA § 121 (42 U.S.C.A. § 9621) that remedial actions for the cleanup of hazardous substances must comply with the requirements, criteria, standards, or limitations under federal or more stringent state environmental laws that are legally applicable or relevant and appropriate to the hazardous substances or circumstances at a site. The EPA defines and explains ARARs using two categories. First, the EPA categorizes ARARs as being either "applicable" or "relevant and appropriate" to a site. The terms and conditions pertinent to this category are detailed in the following paragraphs.

- "Applicable" requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site (40 C.F.R. § 300.5).

- "Relevant and appropriate" requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting laws that address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site (40 C.F.R. § 300.5).

- Requirements under federal or state law may be either applicable or relevant and appropriate to CERCLA cleanup actions, but not both. If a requirement is not applicable, it must be both relevant and appropriate in order for it to be an ARAR. In cases where both a federal and a state ARAR are available, or where two potential ARARs address the same issue, the more stringent

regulation must be selected. However, in cases where the implementation of a federal environmental program has been delegated by the EPA to a state, it would be the analogous state regulations which would be considered ARARs.

- Other information that does not meet the definition of an ARAR may be necessary to determine what is protective or may be useful in developing CERCLA remedies. In addition, ARARs do not exist for every chemical or circumstance that may be found at a CERCLA site. Therefore, the EPA believes it may be necessary, when determining cleanup requirements or designing a remedy, to consult reliable information that would not otherwise be considered a potential ARAR. Criteria or guidance developed by the EPA, other federal agencies, or states may assist in determining, for example, health-based levels for a particular contaminant or the appropriate method for conducting an action for which there are no ARARs. The CERCLA categorizes this other information as TBC. The TBC information may be used as guidance when developing CERCLA remedies. Materials considered TBC information generally fall within three categories: (1) health effects information, (2) technical information on how to perform or evaluate investigations or response actions, and (3) policy. A possible fourth category for TBC information is proposed regulations, when they are noncontroversial and likely to be promulgated as drafted.

The second EPA categorization for ARARs is based on whether the ARARs are specific to the chemical(s) present at the site (i.e., chemical-specific), the remedial action being evaluated (i.e., action-specific), or the location of the site (i.e., location-specific). The terms and conditions pertinent to this second category are detailed in the following paragraphs.

- "Chemical-specific" ARARs usually are health- or risk-based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may remain in, or be discharged to, the ambient environment [53 Fed. Reg. 51437 (December 21, 1988)].

- "Action-specific" ARARs usually are technology- or activity-based requirements or limitations placed on the remedial action being evaluated. Selection of a particular remedial action at a site will trigger action-specific ARARs which specify appropriate technologies and performance standards [53 Fed. Reg. 51437 (December 21, 1988)].

- "Location-specific" ARARs generally are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they occur in special locations. Some examples of special locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats [53 Fed. Reg. 51437 (December 21, 1988)].

Examples of chemical-, action-, and location-specific ARARs:

- Chemical-specific ARARs — Maximum contaminant levels, KPDES effluent limits, etc.;

- Action-specific ARARs — Performance and design standards; and

- Location-specific ARARs — Preservation of historic sites, regulations pertaining to activities within or near wetlands or floodplains, etc.

As discussed in the preamble to the NCP, potentially responsible parties (PRPs) conducting remedial actions, or portions of remedial actions, entirely onsite, as defined in 40 C.F.R. § 300.5, must comply with the substantive portions of ARARs but not the procedural or administrative requirements [53 Fed. Reg. 51443 (December 21, 1988)]. Substantive requirements pertain directly to the actions or conditions at a site, while administrative requirements (e.g., permit applications) are paperwork requirements that could delay remedial action implementation.

The CERCLA § 121(d)(4) [42 U.S.C.A. § 9621(d)(4)] provides several ARAR waiver options that may be invoked, provided that human health and the environment are protected. Finally, under CERCLA § 121(e) [42 U.S.C.A. § 9621(e)], PRPs (such as the DOE) are not required to obtain federal, state, or local permits in order to conduct on-site response actions.

In addition to ARARs and TBC information, the EPA has addressed other standards pertinent to CERCLA cleanups. In the NCP, at 40 C.F.R. § 300.150, the EPA has addressed the relationship of ARARs to worker protection standards. The EPA states that CERCLA response actions must comply with the worker protection standards and requirements of the Occupational Safety and Health Act of 1970 (29 U.S.C. §§ 651 through 678) and analogous state laws; however, the standards and requirements are not ARARs [55 Fed. Reg. 8680 (March 8, 1990)].

Likewise, the DOE, in Order 5480.4, *Environmental Safety and Health Standards*, establishes general requirements for environmental protection, safety, and health standards for the DOE and DOE contractor operations. The Order addresses DOE activities during the design, construction, operation, modification (if any), and decommissioning phases of the remedial action.

Finally, in 10 C.F.R. § 835, the DOE sets forth occupational standards for radiation protection at its facilities. Pursuant to this regulation, exposure of general employees from DOE activities, other than planned special exposure or emergency exposure situations, are to be controlled so that the following annual radiation dose limits are not exceeded: a total effective dose equivalent of 5 rem; the sum of the deep dose equivalent for external exposures and the committed dose to any organ or tissue, other than the lens of the eye, of 50 rem; an eye lense dose equivalent of 15 rem; and a shallow dose equivalent of 50 rem to the skin or any extremity.

2.10.2 Relationship Between the Scope of the Selected Remedial Action, Regulatory Authorities, and Applicable or Relevant and Appropriate Requirements

The remedial actions identified in this ROD are intended to protect human health by minimizing exposure to acidic leachate seeping from the landfill banks into adjacent surface-water bodies. These actions are not intended to address remediation of any existing or future surface- or ground-water contamination at this site. The DOE will evaluate the necessity for surface- and/or ground-water remedial actions for the SWMUs in WAGs 1 and 7 separately from this action during site-wide, comprehensive evaluations of surface- and ground-water contamination at this site.

As part of the comprehensive evaluations, the DOE, the EPA, and the KDEP will determine whether implementing surface- and ground-water remedial actions at SWMU

8 is necessary to protect human health and the environment. Through the comprehensive evaluations for surface water (WAGs 18 and 25) and ground water (WAG 26), known also as the CSOUs, the remedial action alternatives for the surface water and ground water at the PGDP, including at WAGs 1 and 7, will be selected. Through the CSOU process, all data on the surface and ground water at WAGs 1 and 7, and at the other PGDP SWMUs will be evaluated. Finally, all risks to human health and the environment from the surface and ground water at the PGDP, and all legally ARARs also will be evaluated.

While CERCLA § 121(d)(2)(A) [42 U.S.C.A. § 9621(d)(2)(A)] requires that the RCRA (42 U.S.C.A. §§ 6901 to 6992k) and other environmental laws be evaluated as ARARs, this, in no way, limits or negates the Commonwealth of Kentucky's authority pursuant to K.R.S. Chapter 224, subchapter 46 and the PGDP Kentucky Hazardous Waste Management Permit, KY8-890-008-928. This subchapter provides the KDEP with statutory authority to regulate hazardous waste in Kentucky.

The chemical-, action-, and location-specific ARARs and TBC information for the selected remedial actions are described in the following paragraphs.

2.10.3 Chemical-Specific Applicable or Relevant and Appropriate Requirements

The following discussion describes the chemical-specific ARARs and TBC information for the selected remedial action. All chemical-specific ARARs will be met through implementation of the selected remedial action.

2.10.3.1 Leachate discharges

Since discharges of leachate from the C-746-K Sanitary Landfill into waters of the Commonwealth have been documented, the substantive requirements applicable to point source discharges under the Clean Water Act (CWA) (33 U.S.C.A. §§ 1251 to 1387) are legally applicable to the site under the CERCLA. The EPA has authorized the KDEP to operate its KPDES program in lieu of the CWA. The KPDES program must be administered consistently with CWA requirements. Typically, at non-CERCLA sites, the KDEP issues a KPDES permit to regulate point source discharges. Such KPDES permits contain effluent discharge limits to ensure compliance with the water quality criteria found in 401 K.A.R. Chapter 5.

However, because the PGDP is a CERCLA site, the permit exemption of CERCLA § 121(e)(1) [42 U.S.C.A. § 9621(e)(1)] applies. This provision of the CERCLA exempts portions of remedial actions conducted onsite from having to comply with administrative requirements, such as the acquisition of a KPDES permit. The provision is written into the CERCLA not to lessen the burden of any substantive environmental requirements, but to reduce paperwork requirements that Congress believed potentially could delay the implementation of remedial measures. Thus, even though the acquisition of a KPDES permit is not being incorporated as part of the remedial action, the remedial action still will comply with the substantive requirements of the KPDES program.

The substantive requirements of the KPDES program are contained in various sections of 401 K.A.R. §§ 5:031, 5:065, and 5:070. Additionally, 401 K.A.R 5:029 § 2 is the KDEP's nondegradation policy for surface waters. The policy states that current uses of surface water must be protected. The substantive requirements of the KPDES program and the KDEP's nondegradation policy are applicable requirements under the CERCLA. These requirements are discussed in the following text.

The KDEP regulation 401 K.A.R. 5:031 § 2 contains the minimum water quality criteria for all surface waters in the Commonwealth. The KDEP regulation 401 K.A.R. 5:031 § 4(1) contains the water quality criteria for surface waters, including Bayou Creek, which are suitable for warm-water aquatic species. Pursuant to 401 K.A.R. 5:065 § (2)(4), point source discharges from the C-746-K Sanitary Landfill cannot result in violations of the applicable water quality criteria within the stream. After consultation with the EPA and the KDEP, the DOE has determined that discharges from the landfill currently are not violating substantive KPDES standards (see Appendix B). Thus, the DOE has concluded that the selected remedial action will meet all water quality ARARs for surface waters.

The requirement that CERCLA actions comply with environmental monitoring requirements is contained in the preamble to the NCP at 55 Fed. Reg. 8757 (March 8, 1990). As part of the remedial action, and pursuant to 401 K.A.R. 5:065 § 1(12)(d) and 5:070 § 3, instream monitoring of Bayou Creek will be conducted to document compliance with KPDES requirements. The monitoring of Bayou Creek is further discussed in Section 2.9 of this ROD. The monitoring will continue, as described, in Section 2.9 unless and until the DOE and the KDEP agree to a modification, or a court of competent jurisdiction so orders.

2.10.3.2 Radiation protection of the public and the environment

The DOE Order 5400.5 applies to radiation exposure to the general public from all DOE activities, including routine activities, remedial actions, and naturally occurring radionuclides released by DOE processes and operations and is TBC information. The DOE Order 5400.5 limits radiation exposure to members of the public to a total effective dose equivalent of less than 100 mrem/yr, or 5 mrem/yr to any organ. The Order also specifies derived concentration guidelines for inhaled radionuclides and mandates that DOE personnel and contractors strive to ensure that radiation doses to members of the public are as low as reasonably achievable (ALARA) below the appropriate limits.

2.10.3.3 Radionuclide emission standard

On-site activities involved with the construction and/or implementation of the remedial action could produce airborne pollutants. It is not expected that any radionuclide emissions would result from these activities; however, if radionuclide emissions were to occur, emission standards for DOE facilities would apply. Federal regulation 40 C.F.R. § 61.92 promulgated pursuant to the Clean Air Act of 1970, as amended by the Clean Air Act of 1990, [42 U.S.C.A. §§ 7401 to 7671(q)] sets a total emission standard for radionuclides, other than radon, from DOE facilities. The regulation requires the DOE to ensure that emissions from its facilities do not exceed those amounts that would cause any member of the public to receive, in any given year, an effective dose equivalent of 10 mrem/yr. The regulation is an applicable requirement for the remediation of SWMU 8.

The chemical-specific ARARs and TBC information for the selected remedial action are contained in Table 2-3.

2.10.4 Location-Specific Applicable or Relevant and Appropriate Requirements

The following discussion describes the location-specific ARARs and TBC information for the selected remedial action. All location-specific ARARs will be met through implementation of the selected remedial action.

Table 2-3. Chemical-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Information for Solid Waste Management Unit 8 of Waste Area Group 7

Medium	Requirements	Prerequisites	Federal Citation	Kentucky Citation 401 K.A.R.
Leachate discharges	Current uses of surface water must be protected.	Discharges or releases into waters of the Commonwealth — **Applicable.**		5:029 § 1
	Discharges must not exceed discharge limits set pursuant to the KPDES program.	Discharges or releases into waters of the Commonwealth — **Applicable.**		5:031 §§ 2 and 4(1) 5:065 § 2(4)
	Discharges must be monitored to document compliance with the KPDES program.	Discharges or releases into waters of the Commonwealth — **Applicable.**		5:065 § 1(12)(d) 5:070 § 3
Radionuclides — all exposure pathways	General public must not receive an effective dose equivalent greater than 100 mrem/yr, or 5 mrem/yr to any organ from all exposure modes. All releases of radioactive material must be ALARA.	Exposure of the general public from any source of radiation exposure at a DOE facility — **TBC on a facility-wide basis.** Release of radioactive material from DOE activities — **TBC.**	DOE Order 5400.5 DOE Order 5400.5	
	Emissions from DOE facilities shall not cause members of the public to receive, in any year, an effective dose equivalent greater than 10 mrem/yr.	Emissions of radionuclides other than radon from DOE facilities — **Applicable on a facility-wide basis.**	40 C.F.R. § 61.92	

Wetlands and a 100-year floodplain have been identified in the vicinity of SWMU 8. Construction activities must avoid or minimize adverse impacts on wetlands and act to preserve and enhance their natural and beneficial values [Executive Order 11990; 40 C.F.R. § 6.302(a); 40 C.F.R. § 6, Appendix A; and 10 C.F.R. § 1022]. In addition, construction activities must minimize potential harm to the 100-year floodplain (Executive Order 11988 and 10 C.F.R. Part 1022).

The DOE will avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and wetlands [10 C.F.R. 1022.3(a)]. The DOE will undertake a careful evaluation of the potential effects of any DOE action conducted in a floodplain [10 C.F.R. 1022.3(c)]. Construction in wetlands should be avoided unless there are no practicable alternatives [40 C.F.R. § 6.302(a)]. Degradation or destruction of wetlands must be avoided to the extent possible [40 C.F.R. § 230.10 and 33 U.S.C. § 1344(b)(1)]. Considerations about the protection of wetlands must be incorporated into planning, regulating, and decision making [10 C.F.R. § 1022.3(b)]. Any action involving the discharge of dredged or fill material into wetlands must be avoided to the extent possible (13 U.S.C. § 1344, 40 C.F.R. § 230, and 33 C.F.R. §§ 320 to 330).

Discharges of dredged or fill material for which there are practicable alternatives with fewer adverse impacts or those which would cause or contribute to significant degradation are prohibited [40 C.F.R. § 230.10(a)]. Discharges are also prohibited unless there are no practicable alternatives, and practicable, appropriate mitigation methods are available [40 C.F.R. § 230.10(d)]. Further, 40 C.F.R. § 230.10(b) prohibits discharges that cause or contribute to violations of state water quality standards, violate toxic effluent standards or discharge prohibitions (33 U.S.C. § 1317), or jeopardize threatened and endangered (T&E) species or their critical habitat under the Endangered Species Act (16 U.S.C. § 1531, *et seq.*). If it becomes apparent that impacts to wetlands are unavoidable, due to the construction plan or other modifications, the specific requirements of 61 Fed. Reg. 65920 NWPs or 33 C.F.R. § 325 (Processing of General Permits), and statutes governing discharges of dredged or fill material into waters of the United States would become applicable. The NWP applicable to the selected remedy is NWP 38.

Nationwide Permit 38 is applicable to this project. Nationwide permits are permits authorized by the COE on a nationwide basis for activities deemed to have little to no adverse effects on waters of the United States. Specific requirements applicable to all NWPs must be followed. These requirements are defined in 61 Fed. Reg. 65920 (December, 13 1996). However, notification is not required for CERCLA actions and, consequently, not required for this action [61 Fed. Reg. 65905-65906 (December 13, 1996)].

As required by 401 K.A.R. 4:060, activities or structures exempted by 401 K.A.R. 4:020, which include activities authorized by the COE NWP, may be placed within the regulatory floodway limit of a stream only if they are not of such nature as to result in increases in flood elevations. Riprap and MW 303-A will be placed within the 100-year floodplain. The ARARs for floodplains will be met as long as construction equipment remains on the bank and the original contours are reconstructed as much as practicable, thereby eliminating any possible flood elevation changes. If construction plans are modified, those ARARs listed in Table 2-4 for wetlands may become applicable. Consequently, if construction plans change, or different remedial actions are chosen in the future, the action would require reevaluation for location-specific ARARs.

Table 2-4. Location-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Information for Solid Waste Management Unit 8 of Waste Area Group 7

Actions	Requirements	Prerequisites	Federal Citation	Kentucky Citation 401 K.A.R.
Protection of wetlands	Avoid or minimize adverse impacts on wetlands to preserve and enhance their natural and beneficial values.	Any federal action that will have an impact on wetlands — **Applicable if avoidance is not met.**	10 C.F.R. § 1022; Executive Order 11990	
	Avoid degradation or destruction of wetlands to the extent possible.	Any action involving discharge of dredged or fill material into wetlands — **Applicable if avoidance is not met.**	40 C.F.R. § 230.10; 13 U.S.C. § 1022.3(b)	
	Incorporate considerations about protection of wetlands into planning, regulating, and decision making.	Any federal action that will have an impact on wetlands — **Applicable if avoidance is not met.**	10 C.F.R. § 1022.3(b); 33 C.F.R. § 330 61 Fed. Reg. 65920	
Discharge of dredged or fill material into navigable water	Discharges for which there are practicable alternatives with fewer adverse impacts or those which would cause or contribute to significant degradation are prohibited.	Any action involving discharge of dredged or fill material into wetlands — **Applicable if avoidance is not met.**	40 C.F.R. § 230.10(a)	
	Significant degradation is prohibited unless appropriate steps are taken to minimize impacts on the aquatic ecosystem.	Any action involving discharge of dredged or fill material into wetlands — **Applicable if avoidance is not met.**	40 C.F.R. § 230.10(c)and(d)	

Table 2-4. Location-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Information for Solid Waste Management Unit 8 of Waste Area Group 7 (Continued)

Actions	Requirements	Prerequisites	Federal Citation	Kentucky Citation 401 K.A.R.
Discharge of dredged or fill material into navigable water (continued)	Discharges which cause or contribute to violations of state water quality standards, violate toxic effluent standards or discharge prohibitions, or jeopardize species under the Endangered Species Act.	Any action involving discharge of dredged or fill material into wetlands — **Applicable if avoidance is not met.**	40 C.F.R. § 230.10(b)	
Protection of floodplains	Avoid construction in any 100-year floodplain.	Any federal action within a 100-year floodplain — **Applicable.**	10 C.F.R. § 1022 Executive Order 11988	
	Avoid activities or structures within the regulatory floodway limits of a stream if they result in an increase in flood elevations.	Any action within the regulatory floodway limits — **Applicable.**		4:060 § 4(2)

2.10.5 Action-Specific Applicable or Relevant and Appropriate Requirements

The following discussion describes the action-specific ARARs and TBC information for the selected remedial action. All action-specific ARARs will be met through implementation of the selected remedial action.

2.10.5.1 Solid waste management unit corrective action

The regulations that apply to the cleanup of SWMUs are ARARs for the selected remedial action. Pursuant to the RCRA [42 U.S.C.A. §§ 6901 through 6992(k) and K.R.S. Chapter 224, subchapter 46] the regulations that apply are 40 C.F.R. § 264.101 and 401 K.A.R. 34:060 § 12. These laws and regulations do not contain specific cleanup standards. Rather, the regulations require that the corrective action measures taken must result in the protection of human health and the environment. These regulations are applicable requirements under the CERCLA.

2.10.5.2 Environmental performance standards

The environmental performance standards of 401 K.A.R. 47:030 set minimum numeric and narrative criteria for all solid waste sites and facilities located in Kentucky. The standards establish minimum criteria for the protection of the environment. Included are standards for floodplains (§ 2), wetlands (§ 13), endangered species (§ 3), air (§ 10), surface water (§ 4), ground water (§§ 5 and 6), and food chain crops (§ 7). The standards also contain provisions to ensure safety (§ 11), prevent the site or facility from becoming a public nuisance (§ 12), and restrict practices related to the disposal of PCBs (§ 8) and disease carrying vectors (§ 9). Finally, Section 14 of the regulation requires that no solid waste site or facility violates any provision of K.R.S. Chapter 224. Except for the provisions related to the contamination of surface water and ground water (§§ 4 through 6), the standards, which first took effect in 1990, are relevant and appropriate to the C-746-K Sanitary Landfill, which closed in 1982. The surface-water and ground-water contamination provisions are not relevant and appropriate because any cleanup of the surface water and ground water at or adjacent to SWMU 8 would be beyond the scope of the selected remedial action.

2.10.5.3 Ground-water protection

As required by 401 K.A.R 5:037, any person conducting certain waste-handling activities must implement practices to prevent the pollution of ground water. The regulation is an applicable requirement under the CERCLA; thus, the substantive provisions of the regulation are ARARs even though ground-water remediation is beyond the scope of the remedial action.

Section 3(7) of the regulation states that ground-water protection practices may be incorporated by other federal, state, and local regulatory programs that contain the following three standards: (1) management and design standards; (2) mandatory monitoring for ground-water pollution or methods of detecting discharges, spills, or releases to ground water; and (3) specific corrective action criteria. Through the CERCLA, the RCRA, Kentucky's hazardous waste management program, and the PGDP Groundwater Protection Program Plan (GPPP) (MMES, KY/ER-2 Rev. 1, January 1992), the three standards will be met by the selected remedial action. First, the design parameters for the remedial action technology have been reviewed by the EPA and the KDEP. Second, the CERCLA, the RCRA, and the KDEP's hazardous waste programs require ground-water monitoring to evaluate the effectiveness of the remedial action and the GPPP defines how the KDOW will implement such monitoring. Finally, the specific

corrective action criteria for ground water will be addressed by the ground water CSOU for the PGDP and incorporated into a ROD and/or the PGDP RCRA Permits.

2.10.5.4 Ground-water monitoring plan

Section 4 of 401 K.A.R. 48:300 requires a ground-water monitoring plan which contains: (a) the number, location, and depth of proposed monitoring points; (b) preoperational data showing existing ground-water quality; and (c) a ground-water SAP. The provisions of Section 4, which first took effect in 1990, are relevant and appropriate for the selected remedial action at the C-746-K Sanitary Landfill, which closed in 1982. Moreover, the provisions of Section 4 have and will continue to be complied with through the RFI Workplan, interim corrective measures at the SWMU, and the semiannual reporting on the unit that the DOE provides to the KDEP and the EPA. Documentation on these activities may be obtained through the Administrative Record for the Cleanup of the PGDP, 175 Freedom Boulevard, Kevil, Kentucky 42053, (502) 462-2550.

2.10.5.5 Design requirements for ground-water monitoring systems

Section 5 of 401 K.A.R. 48:300 contains design requirements for ground-water monitoring systems. Section 5 requires a reference or background well and at least three monitoring wells at a point hydraulically downgradient from where the waste was disposed. Like Section 4, Section 5 of the regulation also is relevant and appropriate, and documentation on the ground-water monitoring program at the C-746-K Sanitary Landfill can be obtained through the AR.

2.10.5.6 Monitoring well construction

Ground-water monitoring well construction requirements of 401 K.A.R 48:300 § 6 are relevant and appropriate requirements under the CERCLA because a ground-water monitoring well will be installed as part of the remedial action. The well, tentatively planned as MW 303A, will be used to determine whether any contaminants from SWMU 8 are entering the Terrace Gravel. Monitoring Well 303A will become part of the existing ground-water monitoring program discussed more fully in Section 2.9 of this ROD.

The following is a discussion of each legally applicable requirement of 401 K.A.R. 48:300 § 6.

- Precautions must be taken during the drilling and construction of the monitoring well to avoid introducing contaminants into the borehole. Only potable water will be used in drilling the well and drilling muds will not be used [401 K.A.R. 48:300 § 6(1)].

- All equipment to be placed into the boring will be decontaminated prior to use at the site [401 K.A.R. 48:300 § 6(2)].

- Monitoring wells must be cased to maintain the integrity of the monitoring well borehole; have a minimum diameter of four inches, unless otherwise approved by the KDEP; have screens and appropriate gravel or sand packing; protrude at least one foot above the ground; be four inches smaller than the outside diameter of the drill hole; produce an annular space above the sampling depth that is sealed to prevent contamination of samples and

the ground water; and if the casing is plastic, be threaded and gasket sealed, unless otherwise approved by the KDEP [401 K.A.R. 48:300 § 6(3)].

- The monitoring well casing must be enclosed in a protective cover that: (1) includes a protective barrier; (2) is installed into firm rock; (3) is grouted and placed with a cement collar below the frost line; (4) is numbered and painted in a highly visible color; (5) protrudes at least one inch higher above grade than the monitoring well casing; (6) has a locked cap; and (7) is made of steel or any other material of equivalent strength [401 K.A.R. 48:300 § 6(4)].

- The monitoring well must have a concrete pad extending two feet around the well and be sloped away from the well [401 K.A.R. 48:300 § 6(5)].

2.10.5.7 On-site activities

On-site excavation activities may produce airborne pollutants. Particulate emission levels from earth-moving and site-grading activities are not expected to exceed Kentucky Division of Air Quality regulations for fugitive dust emissions, found in 401 K.A.R. 63:010. The following provisions of this regulation are applicable under the CERCLA.

A requirement of 401 K.A.R. 63:010 § 3 is that reasonable precautions be taken to prevent particulate matter from becoming airborne. Such precautions include the use of water or chemicals, if possible, and/or placement of asphalt or concrete on roads and material stockpiles to control dust [401 K.A.R. 63:010 § 3(1)(b)]. Visible fugitive dust must not be discharged beyond the property line where the dust originated [401 K.A.R. 63:010 § 3(2)]. Additionally, all open-bodied trucks that operate outside the property boundary and that may emit materials that could be airborne must be covered [401 K.A.R. 63:010 § 4(1)].

2.10.5.8 Deed notice

As part of the remedial action for SWMU 8, the DOE will file a notice and deed restrictions with McCracken County, Kentucky, authorities to restrict the uses of the property and to let prospective purchasers and others know that the property was used for waste disposal activities.

In so doing, the DOE will be complying with 401 K.A.R 48:170 § 3(5) which requires the filing only of the deed notice. The regulation, which first took effect in 1990, is relevant and appropriate for the action being taken at the landfill, which closed in 1982.

2.10.5.9 Hazardous waste determination

Soils excavated during the construction of the selected remedy are expected to be laid across the base of the landfill and seeded or used as on-site backfill material so as not to invoke any land disposal or storage concerns [55 Fed. Reg. 8759 (March 8, 1990)]. However, in the unlikely event that any excavated soil is to be transported beyond SWMU 8 boundaries, a determination of whether the soil is hazardous will be made pursuant to 40 C.F.R. § 262.11 and 401 K.A.R. 32:010 § 2. If the soil to be transported is determined to be hazardous, RCRA Subtitle C and analogous state requirements for the management of hazardous waste would be complied with as applicable requirements under the CERCLA

2.10.5.10 Radioactive waste determination

Pursuant to DOE Order 5820.2A, in the unlikely event any soil is transported beyond SWMU 8 boundaries, the soil would be tested to determine if it is radioactive. The DOE Order 5820.2A establishes internal policies, guidelines, and requirements under which the DOE manages its radioactive and mixed (hazardous and radioactive) waste. Subsequent management of radioactive soil would be conducted in accordance with the DOE order and the Land Disposal Restriction (LDR) Federal Facility Compliance Agreement (FFCA) entered into between the DOE and the EPA Region IV June 30, 1992. Subsequent management of mixed waste would be conducted in accordance with the DOE Order, the LDR-FFCA, Subtitle C of RCRA, and K.R.S. Chapter 224, subchapter 46. The Order ensures that radioactive and mixed wastes are managed in a manner which assures the health and safety of the public, the DOE and its contractor employees, and the environment. The Order requires that external exposures to radioactive material released into surface water, ground water, soil, plants, and animals do not result in an effective dose equivalent which exceeds 25 mrem/yr to any member of the public. As an internal order, it is TBC information under the CERCLA.

2.10.5.11 Construction along streams

Construction materials used in or along either Bayou Creek or the unnamed tributary will be stable and inert, free from pollutants and floatable objects, and meet all appropriate engineering standards, pursuant to 401 K.A.R. 4:060 § 7. The regulation is an applicable requirement under the CERCLA. The action-specific ARARs and TBC information for the selected remedial action are contained in Table 2-5.

2.10.6 Applicable or Relevant and Appropriate Requirements and To Be Considered Information for Solid Waste Management Units 100, 130 through 134, and 136

Under the CERCLA guidance document, *ARARs Q's & A's*, EPA Office of Solid Waste and Emergency Response, 9234.2-01FS, May 1989, an ARARs compliance evaluation is not required for a no action decision because the site already is protective of human health and the environment. Thus, an ARARs analysis for SWMUs 130 through 134 and 136 is not provided because the SWMUs already are protective of human health and the environment.

Tables 2-6 and 2-7, respectively, contain the chemical- and action-specific ARARs and TBC information for SWMU 100, which has as its selected remedial action, the continuation of controls. There are no location-specific ARARs for SWMU 100. The continuation of controls at SWMU 100 would meet all chemical- and action-specific ARARs.

2.11 COST EFFECTIVENESS

The preferred alternative will provide overall effectiveness in reducing the potential for exposure by limiting future land use at the site and limiting exposure to landfill leachate by covering visible seeps with riprap. This preferred remedial action represents the least expensive remedial alternative evaluated that achieves all remedial action objectives. Selection of this remedy provides the greatest cost efficiency for the DOE.

Table 2-5. Action-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Information at Solid Waste Management Unit 8 of Waste Area Group 7

Actions	Requirements	Prerequisites	Federal Citation	Kentucky Citation 401 K.A.R.
SWMU corrective action	Protect human health and the environment.	Release of hazardous waste or constituents from a SWMU — **Applicable.**	40 C.F.R. § 264.101	34:060 § 12
Environmental performance standards	Meet minimum requirements for the protection of the environment.	Any solid waste site or facility — **Applicable.**		47:030 §§ 2, 3, and 7 through 14
Ground-water protection	Implement practices to ensure protection of ground water.	Waste-handling activities which have the potential to alter ground-water characteristics — **Applicable.** However, substantive requirements are incorporated into the CERCLA, RCRA, and Kentucky hazardous waste management programs, and the PGDP GPPP.		5:037 § 3(7)

Table 2-5. Action-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Information at Solid Waste Management Unit 8 of Waste Area Group 7 (Continued)

Actions	Requirements	Prerequisites	Federal Citation	Kentucky Citation 401 K.A.R.
Ground-water monitoring plan	A ground-water monitoring plan must include • The number, location, and depth of proposed monitoring points; • Preoperational data showing existing ground-water quality; and • A ground-water sampling and analysis plan.	Ownership or operation of a solid waste site or facility **— Relevant and Appropriate.** (Note: Compliance with this ARAR has already been achieved through prior submittals.)		48:300 § 4 48:300 § 4(1) 48:300 § 4(2) 48:300 § 4(3)
Design requirements for ground-water monitoring system	The ground-water quality monitoring system must consist of • At least one reference or background monitoring well; and • At least three downgradient monitoring wells.	Ownership or operation of a solid waste site or facility **— Relevant and Appropriate.**		48:300 § 5 48:300 § 5(1) 48:300 § 5(2)
Ground-water monitoring well construction	Monitoring well must be constructed with • Precautions to avoid introducing contaminants into the borehole; • Potable water; and • Decontaminated equipment.	Ownership or operation of a solid waste site or facility **— Relevant and Appropriate.**		48:300 § 6 48:300 § 6(1) 48:300 § 6(1) 48:300 § 6(2)

Table 2-5. Action-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Information at Solid Waste Management Unit 8 of Waste Area Group 7 (Continued)

Actions	Requirements	Prerequisites	Federal Citation	Kentucky Citation 401 K.A.R.
Ground-water monitoring well construction (continued)	Monitoring well casing must			48:300 § 6(3)
	• Maintain the integrity of the monitoring well borehole;			48:300 § 6(3)(a)
	• Have a minimum diameter of 4 inches;			48:300 § 6(3)(b)
	• Have screens and appropriate gravel or sand packing;			48:300 § 6(3)(c)
	• Protrude at least one foot above the ground;			48:300 § 6(3)(d)
	• Be 4 inches smaller than the outside diameter of the drill hole;			48:300 § 6(3)(e)
	• Produce an annular space above the sampling depth to prevent contamination of samples and the ground water; and			48:300 § 6(3)(f)
	• Be threaded and gasket sealed (if plastic).			48:300 § 6(3)(g)

Table 2-5. Action-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Information at Solid Waste Management Unit 8 of Waste Area Group 7 (Continued)

Actions	Requirements	Prerequisites	Federal Citation	Kentucky Citation 401 K.A.R.
Ground-water monitoring well construction (continued)	Monitoring well casing must be enclosed in a protective cover that			48:300 § 6(4)
	• Includes a protective barrier;			48:300 § 6(4)(a)
	• Is installed into firm rock;			48:300 § 6(4)(b)
	• Is grouted and placed with a cement collar below the frost line;			48:300 § 6(4)(c))
	• Is numbered and painted in a highly visible color;			48:300 § 6(4)(d)
	• Protrudes at least one inch higher above the monitoring well casing;			48:300 § 6(4)(e)
	• Has a locked cap; and			48:300 § 6(4)(f)
	• Is made of steel or a material of equivalent strength.			48:300 § 6(4)(g)
	The monitoring well must have a concrete pad extending two feet around the well and be sloped away from the well.			48:300 § 6(5)

Table 2-5. Action-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Information at Solid Waste Management Unit 8 of Waste Area Group 7 (Continued)

Actions	Requirements	Prerequisites	Federal Citation	Kentucky Citation 401 K.A.R.
On-site activities	Precaution must be taken to prevent particulate matter from becoming airborne. Such precautions may include: • Using water or a chemical to control dust; • Placing asphalt or concrete on roads and material stockpiles to control dust; • Ensuring that no visible fugitive dust is emitted beyond the property line; and • Ensuring that all open-bodied trucks are covered if any materials in the truck could become airborne.			63:010
Hazardous waste determination	A hazardous waste determination must be made for excavated soil being transported beyond SWMU boundaries. If the soil is determined to be hazardous, other RCRA Subtitle C requirements would be applicable.	Generation of waste — **Applicable.**	40 C.F.R. § 262.11	32:010 § 2

Table 2-5. Action-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Information at Solid Waste Management Unit 8 of Waste Area Group 7 (Continued)

Actions	Requirements	Prerequisites	Federal Citation	Kentucky Citation 401 K.A.R.
Radioactive waste determination	A radioactive waste determination must be made for excavated soil being transported beyond SWMU boundaries. If the soil is determined to be radioactive, or contain mixed waste, the soil will be managed according to appropriate standards.	Generation of waste: RCRA — **Applicable;** K.R.S. 224 — **Applicable;** DOE Order 5820.2A— **TBC;** and LDR-FFCA— **TBC.**	42 U.S.C.A. §§ 6921 through 6939(e); DOE Order 5820.2A LDR-FFCA	K.R.S. Chapter 224, subchapter 46
Construction along streams	Construction materials used in or along either Bayou Creek or the unnamed tributary must be stable and inert, free from pollutants and floatable objects, and must meet all appropriate engineering standards.	Use of construction materials in stream construction projects — **Applicable.**		4:060 § 7
Deed notice and restrictions	Provide notice to prospective purchasers of the property that waste is buried on site. Restrict uses of the property so that the landfill cap and riprap along the stream banks are not disturbed.	Implementation of the remedial action — **Relevant and appropriate.**		34:070 § 10(2)

Pursuant to the CERCLA, the RCRA is listed as an ARAR in this ROD. This in no way limits or negates the Commonwealth of Kentucky's hazardous waste management authority pursuant to K.R.S. Chapter 224, subchapter 46.

Table 2-6. Applicable or Relevant and Appropriate Requirements and To Be Considered Information for Solid Waste Management Unit 100 of Waste Area Group 1

Contaminant/Medium	Requirements	Prerequisites	Federal Citation	Kentucky Citation 401 K.A.R.
CHEMICAL-SPECIFIC				
Radionuclides — all exposure pathways	General public must not receive an effective dose equivalent greater than 100 mrem/yr, or 5 mrem/yr to any organ from all exposure modes.	Exposure of the general public from any source of radiation exposure at a DOE facility **— TBC on a facility-wide basis.**	DOE Order 5400.5	
	All releases of radioactive material must be ALARA.	Release of radioactive material from DOE activities — **TBC.**	DOE Order 5400.5	
	Emissions from DOE facilities shall not cause members of the public to receive, in any year, an effective dose equivalent greater than 10 mrem/yr.	Emissions of radionuclides other than radon from DOE facilities **— Applicable on a facility-wide basis.**	40 C.F.R. § 61.92	
LOCATION-SPECIFIC				
None				
ACTION-SPECIFIC				
SWMU corrective action	Protect human health and the environment.	Release of hazardous waste or constituents from a SWMU **— Applicable.**	40 C.F.R. § 264.101	34:060 § 12

Table 2-7. Action-Specific Applicable or Relevant and Appropriate Requirements for Solid Waste Management Units 130 through 134 and 136 of Waste Area Groups 1 and 7

Actions	Requirements	Prerequisites	Federal Citation	Kentucky Citation 401 K.A.R.
SWMU corrective action	Protect human health and the environment.	Release of hazardous waste or constituents from a SWMU — **Applicable.**	40 C.F.R. § 264.101	34:060 § 12

Pursuant to the CERCLA, the RCRA is listed as an ARAR in this ROD. This in no way limits or negates the Commonwealth of Kentucky's RCRA authority at the site.

2.12 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES

The objectives for this remedial action are to limit exposure to the landfill leachate by covering visible seep locations with riprap, limiting future land use, and preventing destruction of current containment measures (i.e., the existing landfill cap) by placing a deed notice and restrictions on the property. The effectiveness of the remedial action will be assessed through ground-water and surface-water monitoring. Implementing this remedial action is intended to be the final action taken at this site, as it provides an acceptable level of protection from potential exposure to contaminants present in the landfill leachate. Should monitoring conducted at this site indicate an unacceptable risk to human health or environment in the future, implementing additional remedial actions will be assessed.

2.13 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The CERCLA statutory preference for treatment is not adhered to by the selected remedial action because treatment of the leachate was not deemed necessary or cost effective. This action does satisfy the statutory requirement for protection of human health and the environment.

2.14 DOCUMENTATION OF SIGNIFICANT CHANGES

No significant changes were made.

PART 3

RESPONSIVENESS SUMMARY

3.1 RESPONSIVENESS SUMMARY INTRODUCTION

This responsiveness summary has been prepared to meet the requirements of Sections 113(k)(2)(B)(iv) and 117(b) of the CERCLA, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). These CERCLA provisions require the DOE, as "lead agency," to respond "to each of the significant comments, criticisms, and new data submitted in written or oral presentations" on the WAGs 1 and 7 PRAP.

The DOE has gathered information on the types and extent of contamination found, evaluated remedial measures, and recommended remedial actions that will minimize direct contact with contaminated soil and mitigate migration of contaminants through surface and ground water. As part of the remedial action process, a Notice of Availability regarding the PRAP was published in *The Paducah Sun*, a major regional newspaper of general circulation. The *Proposed Remedial Action Plan for Waste Area Groups 1 and 7 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/06-1428&D2, was released to the general public June 24, 1996. This document was made available to the public at the Environmental Information Center in the West Kentucky Technology Park in Kevil, Kentucky, and at the Paducah Public Library. A 45-day public comment period began June 25, 1996, and continued through August 9, 1996. The PRAP also contained information which provided the opportunity for a public meeting to be held, if requested. Specific groups which received individual copies of the WAGs 1 and 7 PRAP included the local PGDP Neighborhood Council, the Natural Resource Trustees, the SSAB, and the PGDP Environmental Advisory Committee.

In response to comments from the public, the EPA, and the Commonwealth of Kentucky, changes were made to the PRAP. The revised PRAP (*Proposed Remedial Action Plan for Waste Area Groups 1 and 7 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/06-1428&D4) was issued to the public after a Notice of Availability announcing the 45-day public review period was published in *The Paducah Sun* December 22, 1996. During the public comment period (December 23, 1996, through February 5, 1997), the PRAP was made available for public review at the Paducah Public Library and the off-site DOE Environmental Information Center located in the West Kentucky Technology Park in Kevil, Kentucky. The review period was extended 30 days to March 7, 1997, due to public request. Specific groups which received individual copies of the PRAP included the local PGDP Neighborhood Council, Natural Resource Trustees, the SSAB, and the PGDP Environmental Advisory Committee.

3.2 COMMUNITY PREFERENCES/INTEGRATION OF COMMENTS

Public participation in the CERCLA process is required by the SARA. Comments received from the public are considered in the selection of the remedial action for the site. The responsiveness summary serves two purposes: (1) to provide the DOE with information about the community preferences and concerns regarding the remedial alternatives, and (2) to show members of the community how their comments were incorporated into the decision-making process. The following are comments received from the public on the WAGs 1 and 7 PRAP during the public comment periods. The first comment and response refers to the first PRAP and the remaining comments and responses refer to the second PRAP.

Comment: I wish to comment on the proposed remedial action plan for SWMU 8. The alternatives listed do show some promise, but I wish there was a more substantial solution. I understand that funds are limited for this project. I think Alternative 3, the leachate collection system would be the most reliable long term solution. I understand the cost is higher than the proposed Alternative 5 wetland treatment system at half the cost. I have concerns the wetland treatment system will not work. The fact that the wetland is to be evaluated over a two-year period suggests doubt of its effectiveness. It's a 3.5 million dollar bet which translated [into] still higher costs if the problem is not solved. I believe that removing the source of the contamination is the only solution.

Response: In response to this comment, informal public comments, and comments from the EPA and KDEP, the proposed alternative was reevaluated and changed to the current proposed alternative. Risks to human health and uncertainties in performance of the wetland alternative were evaluated, and it was determined that costs for implementation and were not commensurate with the risks posed at the site. Based upon this same rationale, invasive technologies (i.e., excavation) also were screened from further consideration. The current remedy was selected based upon its ability to maintain overall protection of human health and the environment, comply with ARARs, pose no additional risks to the community, and provide cost-effectiveness in remedy selection.

Comment: Is it possible for certain members of the public to be added to a mailing list to receive documents published by the United States Department of Energy? This will further facilitate the public participation process.

Response: The DOE publishes a Notice of Availability for documents available for public review and notices of public meetings for PRAPs in *The Paducah Sun*. The DOE also provides 45-day public comment period which provides citizens time to review each FS and PRAP. Additionally, all reports which document the remedial action process are available to the public in the AR located in the Jacobs Technical Center at 175 Freedom Boulevard, Kevil, Kentucky. The telephone number for the AR is (502) 462-2550 and the facsimile number is (502) 462-2551. The DOE also has established a SSAB to keep the public involved in the decision-making process at the PGDP. In addition to these mechanisms, the DOE will strive in future document releases to ensure public notice is sufficient to provide ample review time. However, due to cost and concerns that DOE would not be treating all members of the public equally if DOE were to selectively distribute the documents, including to members of the public on a DOE mailing list, this is not the practice of DOE at this time.

Comment: The public is extremely concerned about the leachate from the landfill. We don't agree that allowing this leaching to continue complies with CERCLA. It is an uncontrolled release that is prohibited by CERCLA.

Response: The CERCLA does not prohibit uncontrolled releases when they meet CWA requirements and are not harming the environment [42 U.S.C.A. § 9621(b)(1), (d)(1), and (d)(2)(A)(ii)]. The EPA and the KDEP have agreed that a limited action would meet all CERCLA and CWA requirements because landfill discharges are not harming Bayou Creek or the unnamed tributary or violating ARARs. Also, the creek and ground water in the vicinity of the landfill will continue to be monitored with the results reported to the KDEP. This process will ensure that further action would be evaluated if the landfill began releasing significant new discharges.

Comment: There are organics, metals, and radionuclides in the leachate. These contaminants are entering the creek and traveling to the river. This must be having a negative, long-term, cumulative impact on the wildlife in and around the creek and those humans utilizing the water from the river downstream. It is these cumulative effects from all of the discharges at the plant, including air, water, land, and waste storage, which pose the most serious risk to human health and the environment. Yet, it is those cumulative effects from the entire situation at the site which has never been given a hard look by the agency.

Response: The WAGs 1 and 7 investigation indicates that risks associated with SWMU 8 (the C-746-K Sanitary Landfill) in the creeks are not present above unacceptable levels. Additionally, the screening ecological risk assessment indicates that there are minimal impacts to ecological receptors in the creeks. The KDOW also has indicated that the landfill is having no adverse impacts on the creeks. Cumulative impacts will be evaluated thoroughly on a site-wide basis after completion of individual SWMU investigations. The sitewide approach for addressing cumulative risks has been approved by the EPA and KDEP. Finally, as discussed in the previous comment response, the creek and ground water in the vicinity of the landfill will continue to be monitored with the results reported to the KDEP. This process will ensure that further action would be evaluated if the landfill began releasing significant new discharges.

Comment: Commercial landfills now have to install leachate collection systems. This leachate is then removed and treated. While not perfect and without problems, this system is preferable to allowing the contaminants into the environment uncontrolled.

Response: The landfill was closed before leachate control systems became mandatory for landfills. Additionally, the RI and FS indicate that the risks associated with the landfill leachate do not warrant a remedial alternative such as a leachate collection system. A limited action will meet the CERCLA's requirements, which include being protective of human health and the environment.

Comment: The no action alternative for the other sites (in addition to SWMU 8) in the proposal is questionable. These areas need to be blocked off from the public, and runoff from the area needs to be controlled. The five-year review is too long of a period for reviewing the environmental effects of such uncontrolled releases of contaminants. There needs to be ongoing review, including attempts to find out what is in the landfill which is causing radionuclides, organics, and metals to be released uncontrolled into the environment.

Response: With the exception of SWMU 38, which has been deferred until the unit ceases operation, and the KOW SWMUs, for which the DOD has agreed to accept responsibility, the remaining SWMUs within WAGs 1 and 7 do not present an unacceptable risk. The DOE, KDEP, and EPA have agreed that risk levels present at these units require no additional action. With regard to the landfill, as stated previously, surface-water and ground-water monitoring will continue, over the next 30 years and beyond if necessary, to ensure protection of human health and the environment.

Comment: The risk assessments which purportedly were done in conjunction with this proposal should be issued to the public in draft form and subjected to public view. Why should the public accept conclusionary statements in a summary that there is no unacceptable risk? Show us your calculations and let us comment on them.

Response: The baseline risk assessment for WAGs 1 and 7 was performed in accordance with KDEP and EPA Region 4 guidance. The DOE presents the results of the baseline risk assessment in the *Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation Report for Waste Area Groups 1 and 7 at the Paducah Gaseous Diffusion Plant, Paducah Kentucky,* DOE/OR/07-1404&D2. Further, risk management decisions and a summary of the baseline risk assessment are included in the *Feasibility Study for Waste Area Groups 1 and 7 and Kentucky Ordnance Works Solid Waste Management Units 94, 95, and 157 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* DOE/OR/06-1416&D2. The public has access to these documents through the AR and the Paducah Public Library.

Comment: Exactly how can doing next to nothing cost $400,000? What exactly is that money being spent on? What accounts is the money being drawn from, and how does the money match up with the requests submitted in the outyear budget requests when made for these WAGs.

Response: The limited action being taken through the ROD will be in place over the next 30 years and the $400,000 reflects that fact. The $400,000 is the total cost of the project, which includes installing rip-rap, posting warning signs, placing a deed notice and restrictions on the landfill property, and maintaining the landfill over the 30-year time frame. Additionally, two existing wells will be abandoned and replaced with a new well to the base of the terrace gravel. The new well will provide more information about whether SWMU 8 is contaminating ground water beneath the unit. The money for this action is coming from a line item account in the DOE Paducah budget.

APPENDIX A

Schedule

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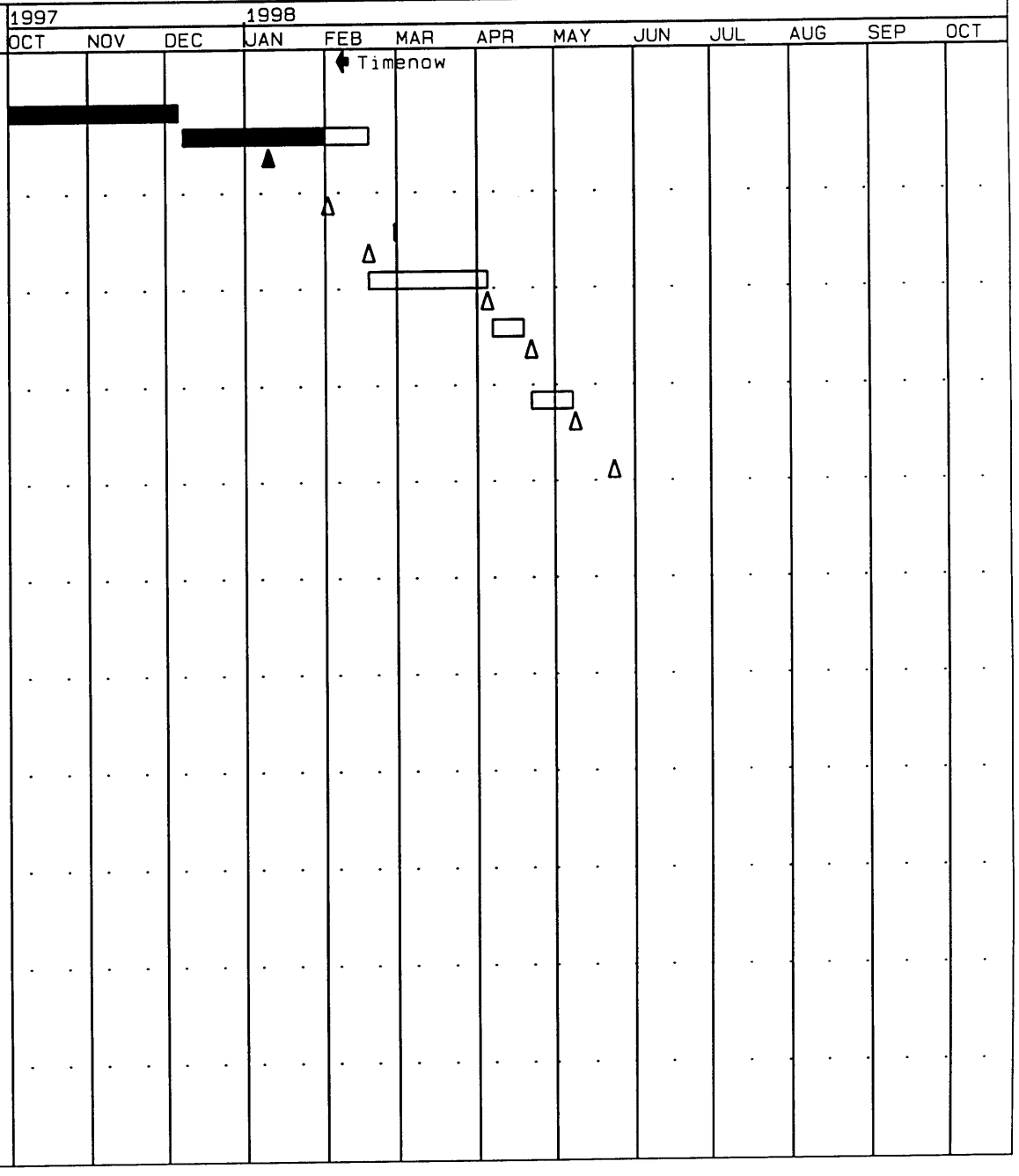
Report: BAR6A
Project: WAG1_7
Time Now: 01FEB98
Date: 11FEB98
Time: 08:28:37
Open Plan (R)

WAGs 1 & 7 – JANUARY SCHEDULE

Legend
=Progress/Complete
=Planned
Sort Key: c2, id

Activity	Description	Start	Finish	Dur
D10406N460	ISSUE D2 ROD TO EPA/KDWM FOR APPROVAL		a02SEP97	0
D10406N470	EPA/KDWM REVIEW D2 ROD	a03SEP97	a05DEC97	94
D10406N472	INCORPORATE EPA/KDWM COMMENTS ON D2 ROD	a08DEC97	17FEB98	72
D10406N474	TRANSMIT COMMENT RESPONSE SUMMARY TO EPA/KDWM		a09JAN98	0
D10406N476	COMMENT RESOLUTION MEETING WITH EPA/KDWM		01FEB98	0
D10406N478	RCRA CERTIFICATION MEETING WITH DOE	28FEB98	28FEB98	1
D10406N481	ISSUE D3 ROD FOR APPROVAL		17FEB98	0
D10406N482	EPA/KDWM REVIEW AND APPROVE D3 ROD	18FEB98	04APR98	46
D10406N490	DOE RECEIVE EPA/KDWM APPROVAL OF D3 ROD		04APR98	0
D10406N499	RECORD OF DECISION SIGNATURE BY DOE	07APR98	18APR98	12
D10406N699	ISSUE SIGNED RECORD OF DECISION TO EPA/KDWM		21APR98	0
D10406N700	EPA/KDWM REVIEW SIGNED ROD	22APR98	07MAY98	16
D10406N799	EPA/KDWM RETURN SIGNED RECORD OF DECSIONS		08MAY98	0
D10406N800	KDWM CONCUR ON ROD		23MAY98	0
07.10.01.01.04.04				
SURVEILLANCE / O&M				
D10406Q700	SURVEILLANCE / O&M FY95	a01OCT94	a30SEP95	365
D10406Q703	SURVEILLANCE / O&M FY96	a01OCT95	a30SEP96	366
D10406Q704	SURVEILLANCE / O&M FY97	a01OCT96	a30SEP97	365
D10406Q705	SURVEILLANCE / O&M	a01OCT96	a31OCT96	31
D10406Q710	SURVEILLANCE / O&M	a01OCT96	a31MAR97	182
D10406Q715	SURVEILLANCE / O&M	a01NOV96	a31DEC96	61
D10406Q720	SURVEILLANCE / O&M	a01DEC96	a31DEC96	31
D10406Q725	SURVEILLANCE / O&M	a01JAN97	a31JAN97	31
D10406Q730	SURVEILLANCE / O&M	a01FEB97	a30MAR97	58
07.10.01.01.10.01				
REMEDIAL DESIGN				
D10406R000	REMEDIAL DESIGN	a18FEB97	a29JUL97	162
D10406R001	RD SCOPING/SCHEDULE	a18FEB97	a12MAR97	23
D10406R300	PREPARE REMEDIAL DESIGN	a03MAR97	a01APR97	30
D10406R329	ISSUE DRAFT REMEDIAL DESIGN TO DOE (D0)		a02APR97	0
D10406R350	DOE REVIEW DRAFT REMEDIAL DESIGN	a03APR97	a08APR97	6
D10406R351	DOCUMENT REVISION	a09APR97	a11APR97	3
D10406R360	CONSOLIDATION & RESOLUTION DRAFT RD COMMENTS	a09APR97	a10APR97	2
D10406R370	DRAFT REMEDIAL DESIGN COMMENTS RESOLVED		a10APR97	0
D10406R380	INCORPORATE DRAFT REMEDIAL DESIGN COMMENTS	a11APR97	a11APR97	1
D10406R399	ISSUE DRAFT REMEDIAL DESIGN TO EPA/KDWM (D1)		a16APR97	0



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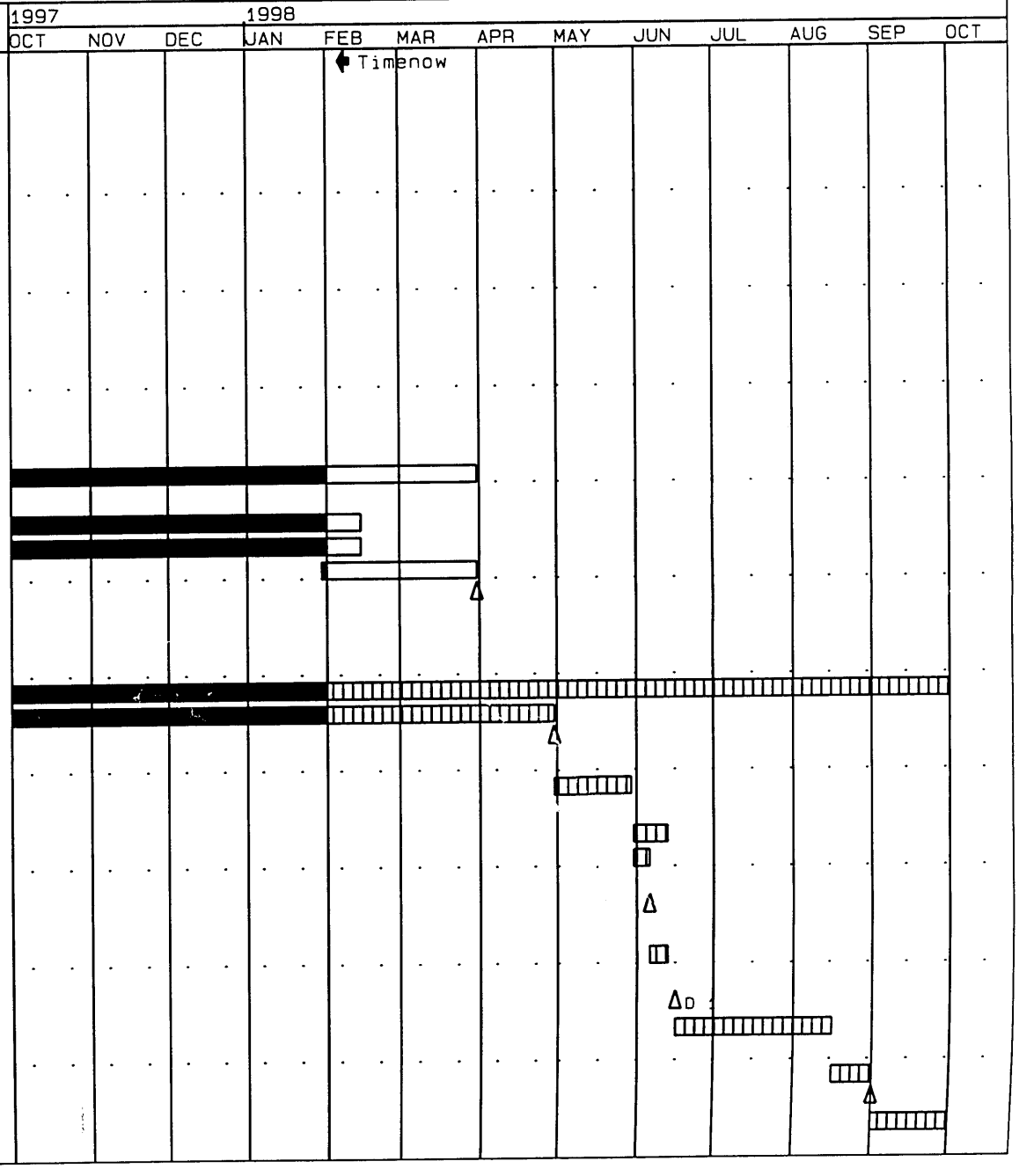
WAGs 1 & 7 – JANUARY SCHEDULE

Legend
■ = Progress/Complete
□ = Planned

Sort Key: c2, id

Activity	Description	Start	Finish	Dur
D10406R400	EPA/KDWM REVIEW DRAFT REMEDIAL DESIGN	a17APR97	a16MAY97	30
D10406R500	ASSESS FLOOD DAMAGE IMPACTS TO RD	a17MAY97	a19JUN97	34
D10406R505	SUBMIT LTR DESCRIBING FLOOD DAMAGE IMPACTS TO RD	a20JUN97	a20JUN97	1
D10406R510	EPA/KDWM REVIEW & COMMENTS ON IMPACTS LTR ON RD	a21JUN97	a28JUL97	38
D10406R599	ISSUE FINAL CFC REMEDIAL DESIGN TO EPA/KDWM (D2)		a29JUL97	0
D10406R699	EPA APPROVE CFC DESIGN (D1 W/IMPACTS LTR ADDENDUM)		a16JUL97	0
D10406R700	KDWM APPROVE CFC DESIGN (D1 W/IMPACTS LTR ADDENDUM)		a28JUL97	0
07.10.01.01.10.02				
REMEDIAL ACTION				
D10406T000	REMEDIAL ACTION - START		a29JUL97	0
D10406T002	REMEDIAL ACTION IMPLEMENTATION	a29JUL97	30MAR98	245
D10406T004	RIP RAP INSTALLATION	a29JUL97	a12AUG97	15
D10406T006	DEED RESTRICTIONS	a18AUG97	13FEB98	180
D10406T008	WARNING SIGNS	a18AUG97	13FEB98	180
D10406T009	GW WELL INSTALLATION & ABANDONMENT	a30JAN98	30MAR98	60
D10406T050	REMEDIAL ACTION - FINISH		30MAR98	0
07.10.01.01.10.03				
POST CONSTRUCTION REPORT				
D10406W200	POST CONSTRUCTION (PC) REPORT	a01OCT97	30SEP98	365
D10406W300	PREPARE POST CONSTRUCTION REPORT	a01OCT97	29APR98	211
D10406W329	ISSUE DRAFT POST CONSTRUCTION REPORT TO DOE (D0)		29APR98	0
D10406W350	DOE REVIEW DRAFT POST CONSTRUCTION REPORT	30APR98	29MAY98	30
D10406W351	DOCUMENT REVISION	31MAY98	12JUN98	13
D10406W360	CONSOLIDATION & RESOLUTION DRAFT PC REPORT COMMNTS	31MAY98	05JUN98	6
D10406W370	DRAFT REMEDIAL POST CONSTRUCTION COMMENTS RESOLVED		05JUN98	0
D10406W380	INCORPORATE POST CONSTRUCTION REPORT COMMENTS	06JUN98	12JUN98	7
D10406W399	ISSUE DRAFT PC REPORT TO EPA/KDWM (D1)		15JUN98	0
D10406W400	EPA/KDWM REVIEW DRAFT POST CONSTRUCTION REPORT	16JUN98	15AUG98	61
D10406W500	INCORPORATE EPA/KDWM COMMENTS	16AUG98	31AUG98	16
D10406W599	ISSUE FINAL PC REPORT TO EPA/KDWM (D2)		31AUG98	0
D10406W600	EPA/KDWM REVIEW FINAL POST CONSTRUCTION REPORT	01SEP98	30SEP98	30



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Report: BAR6A
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WAGs 1 & 7 – JANUARY SCHEDULE

Legend
■ = Progress/Complete
□ = Planned

Sort Key: c2.id

Activity	Description	Start	Finish	Dur
D10406W699	EPA/KDWM APPROVE FINAL POST CONSTRUCTION REPOR		30SEP98	0
D10406W999	PROJECT COMPLETE		30SEP98	0
07.10.01.01.30				
WAG 1_7 - OUTYEARS				
D104063000	WAG 1&7 - FY99	01OCT98	30SEP99	365

1997 | 1998

OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT

Timenow

APPENDIX B

Letter from the Division of Water

JAMES E. BICKFORD
SECRETARY

PAUL E. PATTON
GOVERNOR

COMMONWEALTH OF KENTUCKY
NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION
FRANKFORT OFFICE PARK
14 REILLY RD
FRANKFORT KY 40601

September 11, 1996

Jimmie C. Hodges, Site Manager
Paducah Site Office
United States Department of Energy
P.O. Box 1410
Paducah, Kentucky 42001

Re: C-746-K Landfill
KPDES Permit No.: KY0004049
Paducah Gaseous Diffusion Plant
Paducah, McCracken County

Dear Mr. Hodges:

The UK-Federal Facilities Oversight Unit of the Division of Waste Management, the US Department of Energy and Water Quality and Field Operations Branches of the Division of Water have had several discussions regarding the 1992 Division of Water Notice of Violation for unpermitted discharge and iron staining from the referenced facility. To date the current monitoring program has not revealed an adverse impact on either Big Bayou Creek or the unnamed tributary as a result of this seepage from the landfill. Therefore, it is the consensus of the aforementioned parties that the current monitoring program should be continued in lieu of the installation of treatment. However, should the monitoring program reveal at a future date degradation of either stream's water quality then additional actions may be necessary.

Should you have any questions concerning this matter, please contact me at (502) 564-2225, extension 472.

Sincerely,

Larry J. Bowder, KPDES Permit Writer
Industrial Section
KPDES Branch
Division of Water

LJS:js

c: Division of Water Files
Paducah Regional Office
Tuss Taylor

APPENDIX C

Solid Waste Management Unit 100
Exposure Assessment

EVALUATION OF EXPOSURE AT SOLID WASTE MANAGEMENT UNIT 100

Solid Waste Management Unit (SWMU) 100 (the Fire Training Area) is located within the Paducah Gaseous Diffusion Plant's (PGDP's) perimeter security fence which is identified in the *Site Management Plan, Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* DOE/OR/07-1207&D3, (SMP) as a secured industrial area. Consequently, it is appropriate to evaluate risks to current and future industrial workers based on the amount of time they actually would be in contact with contaminated media at SWMU 100 (i.e., surface water and sediments).

Default exposure assumptions for an industrial worker assume contact with contaminated media for 250 days/yr for 25 years as documented in a United States Environmental Protection Agency (EPA) document, *Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment.* Actual exposures to current industrial workers at SWMU 100 are significantly less. Actual exposures at the unit are due to grass mowing, weed-eating, ground-water sampling, and routine inspections according to information provided by Lockheed Martin Energy Systems, Inc. While each activity likely is performed by a different individual, all activities combined only account for approximately 10 hours of exposure for the entire year. To be conservative, 2 days/yr were used as the actual exposure at the unit for the 25 year time frame [note: all other factors cancel in the equation and are not presented in the attached tables]. The resultant excess lifetime cancer risk (ELCR) and hazard index (HI) risks are well below EPA risk assessment guidance for determining scenarios of concern (i.e., a 1×10^{-4} ELCR and an HI of 1) and are very near *de minimus* (i.e., 1×10^{-6}) with an ELCR of 2×10^{-6} at SWMU 100a and 100b. Consequently, there are no unacceptable risks to current industrial workers at SWMU 100; however, risks to future industrial workers also must be evaluated.

Further evaluation of the ELCR and HI risks at SWMU 100 indicate a risk to a future industrial worker (albeit highly uncertain) exposed to surface-water and sediment contamination for more than 75 days/yr at SWMU 100a, and for more than 130 days/yr at SWMU 100b. Activities in the future are anticipated to be similar to current ones. The reason for this is that the risks at SWMU 100 are from contaminated sediments and surface water in the drainage ditches surrounding the unit. The SMP identifies the PGDP as future industrial facility; therefore, only existing upkeep activities reasonably can be expected to occur in the future, which indicates the site-specific exposure frequency (2 days/yr) would be appropriate under future industrial use. Additionally, institutional controls (i.e., the perimeter security fence, patrol by security) ensure that exposures are limited to industrial workers and provide safeguards (i.e., personal protective equipment) to limit exposures to an industrial worker. Therefore, no further action is required to address the current contamination found at SWMU 100. However, it should be noted that this decision does not mean that current actions do not need to be maintained. Most importantly, this decision rests upon the observation that SWMU 100 and the surrounding area will remain industrialized in the foreseeable future and that SWMU 100a and 100b remain in operation as drainage ditches at which upkeep activities performed do not exceed aforementioned exposure times. These observations are consistent with the expected future use of the area as described in the feasibility study and the SMP.

SWMU 100a CARCINOGENS

Chemical	Default ELCR*	Default Exposure** (days/yr)	Actual Exposure (days/yr)	Actual ELCR
Sediment				
Ingestion	7.00E-06	250	2	5.60E-08
Dermal Absorption	3.00E-03	250	2	2.40E-05
Inhalation	2.00E-08	250	2	1.60E-10
External Exposure	1.00E-06	250	2	8.00E-09
Sum of Pathways	**3E-03**			**2E-05**

SWMU 100a NON-CARCINOGENS

Chemical	Default HI*	Default Exposure** (days/yr)	Actual Exposure (days/yr)	Actual HI
Surface Water				
Dermal Absorption	4.00E-00	250	2	3.20E-02
Sediment				
Ingestion	3.00E-01	250	2	2.40E-03
Dermal Absorption	4.82E+01	250	2	3.86E-01
Inhalation	2.00E-02	250	2	1.60E-04
Sum of Pathways	**5E+01**			**4E-01**

* From the FS report

** Based on EPA guidance

Equation used to complete the table:

$$ARH = (E_a\ (Ea \times RHd)/Ed$$

Where:

ARH = Actual ELCR (risk) or HI (hazard) based on actual exposures

Ea = Actual exposure frequency (i.e., 2 days/yr)

RHd = ELCR or HI value from the FS (based on default exposure assumptions)

Ed = EPA's default exposure assumption (i.e., 250 days/yr)

SWMU 100b CARCINOGENS				
Chemical	**Default ELCR***	**Default Exposure** (days/yr)**	**Actual Exposure (days/yr)**	**Actual ELCR**
Surface Water				
Dermal Absorption	2.00E-06	250	2	1.60E-08
Sediment				
Ingestion	6.00E-06	250	2	4.80E-08
Dermal Absorption	2.00E-03	250	2	1.60E-05
Inhalation	2.00E-08	250	2	1.60E-10
External Exposure	8.00E-07	250	2	6.40E-09
PATHWAY	**2E-03**			**2E-05**

SWMU 100b NON-CARCINOGENS				
Chemical	**Default HI***	**Default Exposure** (days/yr)**	**Actual Exposure (days/yr)**	**Actual HI**
Surface Water				
Dermal Absorption	3.00E-01	250	2	2.40E-03
Sediment				
Ingestion	2.00E-01	250	2	1.60E-03
Dermal Absorption	2.69E+01	250	2	2.15E-01
Inhalation	8.00E-03	250	2	6.40E-05
PATHWAY SUM	**3E+01**			**2E-01**

* From the FS report

** Based on EPA guidance

Equation used to complete the table:

$$ARH = (Ea \times RHd)/Ed$$

Where:

ARH = Actual ELCR (risk) or HI (hazard) based on actual exposures

Ea = Actual exposure frequency (i.e., 2 days/yr)

RHd = ELCR or HI value from the FS (based on default exposure assumptions)

Ed = EPA's default exposure assumption (i.e., 250 days/yr)

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